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NDD

NOVEMBER 1998

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Electronics
in Queensland

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Where do you GO for all new BASIC Stamp technology?

BASIC Stamps are small computers that run PBASIC programs, and communicate with other electronic devices. Their simple language and easy interfacing make BASIC Stamps ideal for many applications, for the hobbyist and for education.

The Stamp 1 and Stamp 2 are 14- and 24-pin modules, with the circuitry packed onto a small module. These modular BASIC Stamps have corresponding carrier boards for easy interfacing to PCs, power supply and prototyping. BASIC Stamps connect to your computer's parallel or serial port for programming. After being programmed they can be connected directly to buttons, LEDs and other TTL-level devices, and with extra components, to non-TTL devices such as relays.

BASIC Stamp 1 Revision E

- Runs PBASIC programs with 8 I/O lines
- 256 bytes EEPROM (program and data)
- 80 instructions maximum program length
- Parallel PC interface
- Insert into a carrier board (K 1402), connect with a cable and program using any IBM PC running DOS
- 9V DC power required
- Size: 1 3/8" x 3/4" x 1/8" (LWH)

K 1401

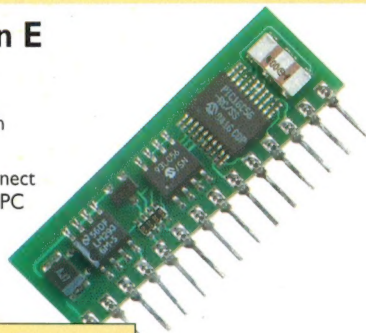
BASIC Stamp 1 Carrier board \$39

K 1402

BASIC Stamp 1 Revision D

Same features as Rev E, but is a complete PC board with prototype area and 9V DC battery clip. **\$79**

K 1400



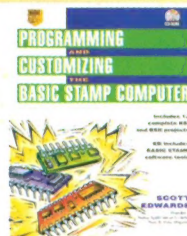
\$79 NEW

Available through mail order, PowerHouse and selected stores

Programming and Customizing the Basic Stamp Computer

A friendly introduction to building projects with BASIC stamps. With 10 complete projects and explanations. This book is a great start if you have no electronic or programming skills.

B 4807



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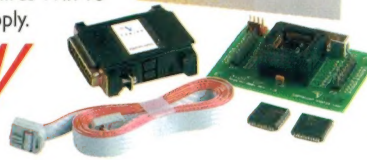
EXCLUSIVE TO DICK SMITH ELECTRONICS
Available in all stores

Vantis Mach 4 Starter Kit

Bring your creative ideas to life from your personal computer using Vantis programmable logic.

This kit is designed as an entry-level introduction to programmable logic and desktop in-system programming. See the article in Electronics Australia Nov '98 for an example of the benefits of using complex programmable logic devices! Kit includes Synario Starter software Rev 2.0, MACHPRO software, cable, programming board, manual, two MACH4 devices and requires Win 95 or NT and 5V power supply.

K 1450



NEW

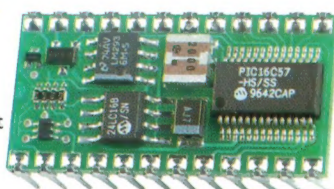
INTRODUCTORY LOW PRICE!

\$99

BASIC Stamp 2

- Features 16 I/O lines
- 2048 bytes EEPROM (program and data)
- 500 instructions maximum program length
- Insert into a carrier board (K 1404), connect with a cable and program using any IBM PC running DOS
- Serial PC interface
- 9V DC power required
- Size: 1 3/16" x 5/8" x 3/8" (LWH)

K 1404



\$109 NEW

Available through mail order, PowerHouse and selected stores

BASIC Stamp 2 Carrier board \$49

K 1403

BASIC Stamp Development kit

- Includes Stamps 1 and 2 manuals, cables for Stamps 1 and 2 programming and software to get you started
- With certificate for 3 mths free technical support

K 1405



BASIC Stamp jumper connectors \$9.95

K 1406

\$149 NEW

Available through mail order, PowerHouse and selected stores

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November 1998 Volume 60, No. 11 www.electronicsaustralia.com.au

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On the cover

Duntech's new Gemstone series of top-end speaker systems offer an excellent way to enhance the quality and impact of your surround sound system — if your budget allows. These and other high-end speakers are discussed in our feature starting on page 14. Our review of the novel Avison Scancopier begins on page 20.



Digital audio's future?



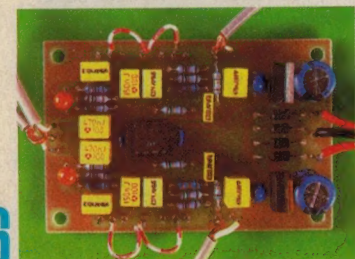
Diamond Multimedia's new handheld MP3 player stores an hour of music in flash memory. No moving parts...

Apple's 15" LCD screen



With bright and hi-res images, it copes not only with PCs and Macs but also with multistandard video!

Flexible tape preamp



Need a preamp for a tape deck? Here's one that's easy to build...

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ELECTRONICS AUSTRALIA is published by FPC Magazines, a division of Eastern Suburbs Newspapers Partnership, which is owned by General Newspapers Pty Ltd.

A.C.N.000 117 322.

Double Bay Newspapers Pty Ltd.

A.C.N.000 237 598, and

Brehmer Fairfax Pty Ltd.

A.C.N.008 629 767.

180 Bourke Road, Alexandria, NSW 2015.

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Distributed by Newsagents Direct Distribution Pty Ltd, 150 Bourke Rd, Alexandria 2015; phone (02) 9353 9911.

ISSN 1328-6218

* Recommended & maximum Australian retail price.

Member of the Audit Bureau of Circulations



Letters to the Editor

Vintage car radios

Your vintage radio columnist Roger Johnson seems to be confounded by American terminology when he refers to the pre-1930 Australian soft top cars as 'touring cars' (Vintage Radio, June '98). They were in fact tourers and roadsters. His reference to 'an enormous amount of road noise' also makes one wonder just what he might have ridden in.

My sources suggest that Marmon (which were represented in Australia up to 1931) would have been among the first to have wireless as standard. The sets would probably have been Delco or Crossley. It is also noteworthy that early suppression efforts relied on ignition shielding rather than the later methods described by Roger. As for the 1930s being the era of the straight-eight in America, that changed with the introduction of the Ford V8 in 1932.

John Harvey, Clermont Qld.

Battery amp-hours

Peter Phillips' Information Centre is great for beginners to electronics and I commend him for it. However he is confused by a battery's amp-hour rating; it's a measure of how long a particular battery can supply a current before the output voltage falls to an unacceptable level (i.e., it goes flat). It's a product of the current drawn multiplied by time; the higher the current the quicker it dies. It doesn't have anything to do with the battery voltage.

If cells are connected in series, the current in each cell is the same and they all discharge together. The voltage and energy available is multiplied by the number of cells. The amp hour rating is not. If it were so, there would be no need for nuclear submarines — just get 10,000 D cells in series and you'd have a 15,000V, 100,000 amp-hour battery. You could sail around the world. That's just ridiculous (you'd need 100 million for this capacity). If you agree I hope Peter will make a correction in his column, as it will have confused many learners.

I also complement your editorial. The Internet has become a giant encyclopaedia which I use all the time and your Web Watch page has many terrific links.

Finally, the What? question in

September's Information Centre (difference in size) is a bit like the length of a piece of string. If Jim is thinking of comparing an atom to the Universe, the size ratio is fairly precise (what type of atom?) but much larger differences are considered. The Quark is the smallest particle known and physicists are looking for any smaller internal structure. They have considered the start of the Universe back to smaller than an atom and are going ever further back; the Universe may expand forever and be only one of perhaps millions of other universes. The human mind has a big imagination.

Don Black (by e-mail).

Thinking back

Being interested in electronics from my school days, I always enjoyed reading those early Radio and Hobbies magazines. I left school in the year of 1955, and commenced work with EMI Australia (HMV) situated at Homebush. I was employed as a Radio laboratory assistant and enjoyed my work so much so that I couldn't wait for Mondays to arrive!

This was my first introduction to Mr Neville Thiele. Neville had an office adjacent to the Radio Laboratory, and in those early days of EMI, I can recall that Neville specialised in designing audio vented enclosures, crossover networks, circuit design, and later was to set new standards for the industry in both radio and television. I could not comprehend the amount of mathematics he would produce describing the design of a speaker enclosure, remembering there were no calculators at that time. His slide rule would never rest.

Although an extremely busy man, he would always make time available to discuss my questions (usually about my latest foreign order project!), in a way that even I could understand. He would always give me the courtesy of a "Good morning", and enquire of my health and work. A true gentleman, who was also blessed with a good sense of humour.

Each week at a particular time in the afternoon, Neville would invite the young engineers (although not classified as such, I would be included) into his office for discussions on circuit design. I recall at the time the theory was way over my head, but I found it extremely interesting

and proved to be an advantage to me in my later years.

In those early years of my 25 years service with EMI (1955-1980), I do feel honoured to have worked with Mr Neville Thiele, for a short but memorable time. Unfortunately I have not seen Neville for nearly 30 years now, but wish him well. I will always remember him for his incredible input to the industry, and of course his kindness and willingness to offer his knowledge at any time of the day. An Australian treasure indeed.

Ray Dixon, Springwood Qld.

Tech shortage

Where have all the techs gone? Well Jim, the days of 'real technicians' are long gone, ever since the bean counters took over. You see when my generation were trained, it was a sin to not be able to fix the set. Now it is a stopwatch job. Oh dear — too dear!

We were trained to fix the set, NO MATTER WHAT.

You know there would be less landfill problems if we reverted to *training* people to carry out the job to its conclusion. Sure the first ones are hard — weren't they always. But then it was C912 or R34, change the tranny and so on. We got that way we would walk into the customer's home with the part and the tools to fit it.

I remember Sonys; how everyone hated them. Well I had to do them, and I got so I could detect what was wrong by the way the set went 'wee bonk' on switch-on.

What about the HMV sets? They were gems, in the B&W era. The colour sets — well, I believe that the Australian industry wasn't ready to make the product. How many knew that the PSU was really a Grundig in disguise?

I still do service — I fix my sets, properly. I don't get paid, as it's a mainly love job now. But I won't work for the stopwatch mob.

Roy Thwaites, Woodberry NSW. ♦

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We welcome contributions to this column, but reserve the right to edit letters which are very long or potentially defamatory.



Reducing the cost of turning us all into least-effort couch potatoes

We've all grown very used to equipment and appliances with remote control and 'instant on' capabilities, haven't we? Well, in so-called developed countries like Australia and New Zealand, anyway. It's all part of the global electronic and electrical products industry's success in meeting our conscious/unconscious desires for greater user convenience — or if you prefer, its compliance in helping we humans make the evolutionary transition into minimum-effort couch potatoes.

In the old days (say 30 years ago), we didn't think twice about walking across the room to turn on the TV or change the channel, or to turn the record over on the hifi. Nowadays it's simply a matter of reaching for the right remote control, and pressing the right button. Most TV receivers have instant-on and remote control functions as standard, as do VCRs, CD players, hifi amplifiers, AM/FM stereo receivers and of course the new DVD players. Many of the new PCs have a similar function, where they'll spring to life as soon as you press any key on the keyboard.

The problem is that all of this convenience comes at a price, and that price is added energy consumption — which leads to higher power bills, more power stations, more fossil fuel consumption

and ultimately more pollution. A recent study by the US Department of Energy's Lawrence Berkeley Laboratory reported that about 20% of 'miscellaneous' domestic power consumption now comes from 'standby losses' (power drawn by appliances that are nominally 'off'), and that this sector of power consumption is growing at nearly 5% per year. It estimated that more than US\$1 billion per year could be saved by reducing the standby power loss of every such appliance, down to one watt.

Apparently some of the latest consumer appliances *do* meet this standby power level already, so the technology is available; it's by no means an impossible goal or 'greenie dream'. The challenge is for *all* manufacturers to adopt this as their norm — and it may be that this won't happen unless we consumers make it plain that we want it to happen. Or perhaps we could pressure our governments to insist on it, although in the current climate of privatised power utilities there's probably a tacit assumption (hope?) that the more energy we all use, the better.

The Berkeley study projected that without policies addressing the current rate of increase in this 'miscellaneous' energy use, it will grow by an additional 50% by 2010, and in the USA require another 15 large (one gigawatt) power stations. So it's not just a minor problem, but a pretty serious one. Perhaps we should have a special regulatory framework to manage appliance energy consumption in both operating and standby modes, just as we now have for EMC compliance.

Either way, it's a clear challenge for designers of electronic and electrical equipment, isn't it? (For more info, see <http://enduse.lbl.gov/Projects/ResMisc.html>)

Jim Rowe

PS: Can I make a small personal request? Recently I've been trying to get a 1960s Brenell reel-to-reel stereo tape deck going again, to make digital transfers of some old tapes. But one winding in the playback head has turned out to be open circuited. Does anyone happen to have a working 'P' or 'R/P' head from one of these decks? I think they were made by Bogen. I'm happy to pay a reasonable price...

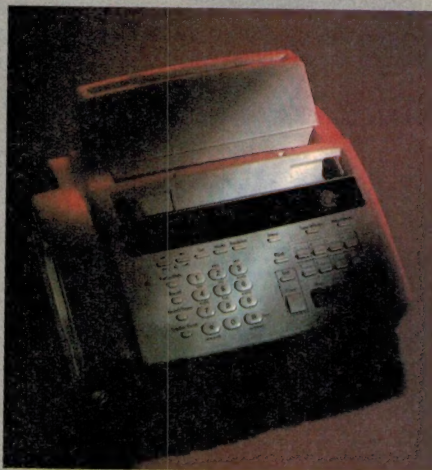
WHAT'S *new*

in the ever-changing world of electronics

7-in-1 for your SOHO

Brother says its new MFC970mc Multi-Function Centre gives you seven office functions, built into one compact unit. It can take messages, 14.4kb/s fax, phone, copy, print, scan and also has a PC fax function — allowing you to send directly from your windows application or receive a fax into your PC, so you can view it before printing. All this for an RRP of only \$749...

The company says the MFC970mc is the only product of its kind to feature a built in 'Message Centre', which includes a digital answering machine and handset, five mail-boxes to store private fax and voice messages, caller ID, fax forwarding and remote



fax and voice retrieval. The distinctive ring detection (Telstra Duet) means that you're able to differentiate between your incoming fax and phone calls, while the unit is easily set up via on-screen programming and built-in help functions.

The MFC970mc has a 100-sheet plain paper cassette and includes 512KB of memory to store up to 20 pages of fax messages or 15 minutes of voice messages. The memory can also be used for time saving features such as broadcasting, next fax reservation and out of paper reception.

For more information circle 141 on the reader service card or contact Brother International (Aust.), 7 Khartoum Road, North Ryde 2113.

New 'information appliance' from HP

Hewlett-Packard has introduced what it describes as a revolutionary new information appliance, the CapShare 910 — a portable scanning device about the size of a personal CD player, designed to make it easy for 'mobile professionals' to capture, store and share information from paper documents while they're away from the office.

The 355-gram device is used to scan newspapers, printed letters or other material using a free-form, swiping motion; the user can capture up to 50 letter/A4 B&W pages and store the information in memory. CapShare's page processing can 'glue' the images together to recreate the documents in as little as six seconds,

showing a 'thumbnail' of it on the built-in LCD display. Documents can then be sent to a printer or smart wireless device via the inbuilt infrared (IrDA 4.0) port, or to a PC for e-mailing or e-faxing, via HP's Jetsend technology. It can export in standard Adobe PDF format.

HP says the CapShare 910 is the first of a new family of smart, easy to use handheld information appliances. In the USA it's expected to sell for around US\$699. (There is more information



at <http://www.capshare.hp.com>)

Colourful personal stereos

Panasonic has expanded its range of 'head-phone stereos' with two new models, the RQ-E30V and RQ-E10V, which are a departure from the firm's predominantly-black existing models.

The RQ-E10V, available in a metallic finish in blue or silver, is very thin and compact. It features auto reverse play-back as well as a digital synthesiser tuner with 20 station memory. New technology means that the new model will play for 23

hours with two regular AA alkaline batteries. For high quality sound



Panasonic's XBS (eXtra Bass System) is included, plus a tape selector for metal or normal tapes.

The RQ-E30V has all the features of the RQ-E10V, with the addition of several features. It will play back for 24 hours powered by only one AA alkaline battery. It also has a battery power checker and five direct preset keys for ease-of-use.

The RQ-E10V and RQ-E30V are available from leading retailers for RRP's of \$109 and \$139 respectively. For more information contact Panasonic's Customer Care Centre on 132 600.

Car receivers control both CD & MD changers



Mobile audiophiles who want the flexibility of having both CD and MD changers on board should find **Kenwood's** new premier CD receivers of interest. The KDC-9010

and KDC-6010 are claimed to incorporate the best modern technology and innovation, along with CD/MD Changer Control.

Both provide multi-colour wide displays

with white LCD (dot matrix on the KDC-9010) selectable key illumination, a menu system for easy operation, and an attenuator with smooth volume return. Each has a Japanese car mount and comes with a remote control unit; the 9010 also features a five-band spectrum analyser and a telephone mute capability. In addition, the KDC-9010 has a gold anodised faceplate with a woodgrain faceplate surround.

The KDC-9010 and KDC-6010 both give up to 40W x 4 maximum power output, and both feature two preouts to feed your active subwoofer or other amp. The KDC-9010 has an RRP of \$999 and the KDC-6010 an RRP of \$849, and they're available at Kenwood dealers throughout Australia.

New VHS camcorders with LCD screens

Panasonic has updated its range of compact VHS camcorders with LCD screens. The three new models — NV-VX22, NV-VX55 and NV-VX77 — have both a swing-out colour LCD screen and a black and white viewfinder.

The NV-VX22 has a 63mm (2.5") LCD monitor and the NV-VX55 a 76mm (3") colour LCD monitor, while the NV-VX77 has an impressive 96mm (3.8") monitor. The LCDs have a non-glare silica coated screen which resists fingerprints and dirt, and easily wipes clean. Multi-angle shooting is possible because the LCD monitor swivels up or down over a 270° range, allowing the user to take shots from any angle. The VX22 has a 61,380 pixel screen

while the VX55 and VX77 have a higher resolution 112,320 pixel screen.

There is a built-in speaker with volume control on each of the cameras for instant playback. The NiMH battery supplied with the VX55 and VX77 allows the user to record for 1 - 1.5 hours or with a larger optional battery three hours of recording. All three models also include an infra-red remote control.

The Panasonic NV-VX22A, NV-VX55A and NV-VX77A camcorders have RRP's of \$1549, \$1799 and \$1999 respectively, and are available from leading retailers. For more information contact Panasonic's Customer Care Centre on 132 600.



'Next generation' rear projection TV



Hitachi says its new 127cm (50") Full Multi-System projection TV system C5068FS represents a huge leap forward in picture quality and ease of use, with new technology never before found in a projec-

tion TV at its price point.

The C5068FS uses a new 'UltraFocus' SuperBright lens system as used in Hitachi's HDTV projection units sold in Japan. It offers a high quality six element, short focus and large diameter lens, giving users a brighter and sharper image. The short focal length also permits a reduction in cabinet depth to that of a standard 27" TV. The SB lens system is complemented by a new CRT design that overall is claimed to give the C5068FS one of the highest PTV brightness figures ever achieved. Hitachi also claim that the overall horizontal resolution of the new PTV is an industry high — 1000 lines.

Also incorporated is Hitachi's MAGnetic Intelligent Convergence system, said to totally eliminate time consuming manual adjustment. At the touch of a button 'MAGIC FOCUS' automatically adjusts the colour guns for the magnetic conditions in the user's actual home theatre environment. Some 256 areas (comprising 16 points each)

on the screen are monitored by eight optical sensors, and corner-to-corner convergence is set within 90 seconds of pressing the button.

Other features include a three-line digital comb filter that provides 1000-line resolution with greatly reduced picture jitter and video interference patterns; the use of a double lenticular screen with fine pitch black-stripe, allowing a wide viewing angle of up to 160° at maximum contrast; and Advanced Velocity Scan Modulation which adjusts the scanning speed of the electron gun when images change from dark to bright, ensuring sharp images under all viewing conditions.

The C5068FS is also supplied with a fully integrated Dolby Pro Logic, three channel Surround Sound system plus Concert Hall and Stadium sound modes. Total audio power is 60W with amplifiers for left and right front speakers, centre and rear speakers (not supplied).

The C5068FS is available from Hitachi dealers nationally and has an RRP of \$7999. For more information circle 144 on the reader service card or contact Hitachi Australia, 13-15 Lyonpark Road, North Ryde 2113.

WHAT'S *new*

in the ever-changing world of electronics

24-hour time lapse VCR

Mitsubishi Electric's new HS-7424E time lapse VCR is claimed to be easier to use, more versatile in its application and to offer improved picture stability. It has a newly designed deck featuring a jog shuttle, which is also used for programming of the unit via an on-screen menu system.

Reviewing playback is also simpler as the shuttle allows the operator to choose the speed at which the tape is reviewed. Not only does the VCR have indexed alarm search and skip search features but a selection of Fast Forward and Slow Forward can all be controlled by the shuttle on the front panel. The shuttle will also facilitate reverse playback, in



different speeds.

The unit also allows series recording, and an RS-232C option allows up to 16 decks to be linked or daisy chained and controlled via a PC, from a single serial communications port.

For more information circle **143** on the reader service card or contact Mitsubishi Electric Australia, 348 Victoria Road, Rydalmere 2116.

MiniDisc finally being born, says TDK

According to media manufacturer TDK, MiniDisc is going through a rebirth (or protracted labour), six years after it was first launched — and is now being talked about as the digital recording medium for the next decade.

A world leader in blank media development and one of only two major manufacturers of MiniDiscs, TDK says it has watched MiniDisc take off in Japan (where the company says it now accounts for over 60% of all hifi sales in the MD format). The firm now sees MiniDisc making big inroads into the European and United States home entertainment and car audio market.

"TDK Australia is expecting a surge in MiniDisc sales in Australia as the advan-

tages of the reborn audio media become more recognised and as the marketing push from manufacturers of both players and discs gathers momentum", said TDK's Promotions Manager, Justin Whitehead. "Since MiniDisc was first released some six years ago, the technology has improved significantly — better processing software means the audio quality is nearly indistinguishable from CD."

MiniDisc is a magneto-optical disc that can be recorded-over virtually an unlimited number of times and, unlike tape, sound quality doesn't change no matter how

many times it is played. TDK's MiniDiscs are guaranteed for one million record/playbacks.

About half the size of a CD, the 64mm diameter MiniDisc is protected by a plastic outer shell, much like a computer floppy disk — yet despite its size it has the same 74-minute audio capacity as a CD, thanks to digital compression technology. TDK's MiniDiscs

range in price from \$7.95 (MD-XG60) through to \$8.95 for the MD-XG74.

For more information circle **142** on the reader service card or contact TDK (Australia), 22 Lambs Road, Artarmon 2064.



New handheld music player has no moving parts

Well known for its video graphics cards and other multimedia/computer components, **Diamond Multimedia** has now released its Rio PMP300, a handheld portable music player which stores up to 60 minutes of MP3 compressed digital music (or 16 hours of voice-quality audio) in 32MB of onboard flash memory. The unit measures only 89 x 64 x 16mm, weighs only 68 grams, and runs for about 12 hours from a single AA alkaline cell.

With no moving parts, the Rio PMP300



is completely insensitive to 'skipping' due to vibration, and is claimed ideal for the next generation of personal music player — the 'Walkperson' of the future, perhaps? Plug-in 30 minute and 60 minute flash memory cards extend its storage capacity.

The Rio PMP300 comes complete with Jukebox MP3 software which allows users to convert music from their CDs into MP3 format, and download into the Rio — along with other music in MP3 format available from Internet sites.

The Rio PMP300 is available in the USA for under US\$200. (You can find out more about it on the web at www.diamondmm.com/rio)

Home theatre receiver includes AC-3 decoder



Onkyo's new TX-DS656 home theatre receiver boasts an impressive array of features and benefits, including five power amplifier channels each of 85 watts output and a built-in Dolby Digital (AC-3) surround sound processor. This ensures that the receiver can extract the highest quality digital audio from your new DVDs, the soon-to-be-released HDTV and other sources.

Six surround modes cater for Dolby Digital, Dolby Pro Logic, Hall, Live, Arena and Studio. Digital Domain Processing is also available, and Onkyo claims this allows the tailoring of all surround modes, without any degradation to the sonic quality of the sound. Cinema RE-EQ circuitry also takes the brightness out of home cinema sound, compensating for the high sound mix for the cinema.

Along with Dolby Digital there are two other digital surround formats now available: DTS and MPEG. To accommodate these, the TX-DS656 has 5.1 channel inputs that enable the use of external decoders.

Comprehensive video and audio routing is accomplished through four audio and four audio/video inputs, for system flexibility. If you are a vinyl lover, there's also a phono input. The optical and coaxial digital inputs (three — one optical and two coaxial) cater to those who wish to connect a DVD, DAT, MiniDisc or CD player and make use of the

Scans documents directly to CD

Document-critical businesses and other organisations which need to maintain extensive archives should find Canon's new CD 4046 digital desktop document archiving system of great interest. It combines a compact high-speed scanner with a built-in CPU and CD writer, providing the convenience and speed of a one-step 'scan-to-store' operation — automatically converting paper documents to digital images and writes them directly to CD.

The CD 4046 has a recording rate of 39 pages per minute, and a high-speed scanning engine that captures double-sided documents in a single pass and performs advanced batching separation. An embedded Write/Read CD-Recordable drive stores up to 650MB (megabytes) of information (around 20,000 pages) on a single disc. Once document storage is completed, the CDs can be inserted in any PC's CD-ROM drive for point-and-click image retrieval from any Windows 95 or Windows NT environment.

The CD 4046 has a 15cm colour touch panel display that controls all functions to make scanning and recording simple. There



are single and double-sided scanning modes. Two contact image sensors read the front and back of a document in a single pass for fast throughput, while the built-in CPU and hard drive facilitate the scan-to-store function. The unit offers 300 or 200dpi scanning, with text and photo mode for added quality in image capture.

The CD 4046 has an RRP of \$9800 ex tax and is available from Canon and selected resellers. For more information circle 145 on the reader service card or contact Canon Australia, 1 Thomas Holt Drive, North Ryde 2113.

TX-DS656's powerful digital signal processing capabilities. High resolution 20-bit Delta Sigma D/A and A/D converters are built in, along with a latest-generation Motorola 24-bit DSP56009 chip running at 88MHz.

The Onkyo TX-DS656 has an RRP of \$1599. For more information circle 140 on the reader service card or contact Amber Technology, Unit B, 5 Skyline Place, Frenchs Forest 2086.

Digital colour copiers double as printers, binders

Sharp expects its new Digital Imager Series of Copiers will revolutionise the term office productivity. The new models will double as printers, ensuring productivity and the added efficiency of being able to create, print, sort and staple documents in one step from a desktop computer, saving up to 60% of costs on a standard laser printer.

The units incorporate Sharp's Electronic Document Handling system, which allows them to scan documents only once and then temporarily store the image on an internal 1GB hard drive, to achieve an efficient 'scan once print many' mode of operation. Full 600dpi output resolution is also available at full engine speed on all three models, ensuring reproduction quality and productivity are never compromised.



The Imager Series also has a zoom function of 800%, as well as 'unlimited trayless duplexing' function in the top end models.

For more information circle 146 on the reader service card or contact Sharp Corporation of Australia, 1 Huntingwood Drive, Huntingwood 2148. ♦

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Apple's Studio 15" LCD Display

This month our reviewer Louis Challis had the opportunity to evaluate Apple Computer's new 15" Studio Display, a true next-generation multimedia, multistandard display which can operate just as easily with your VCR or DVD player as with your computer (Apple or IBM compatible). Based on advanced liquid-crystal display technology, it really impressed him with its bright and high-res images.



NO COMPANY'S IMPACT on the creation and development of the personal computer has exceeded that of Apple Computer. Whilst the company may only have been around for less than a quarter of a century, its impact on the marketplace has been absolutely astounding. From humble beginnings in a Silicon Valley garage in 1976, Apple has grown to be one of the most influential companies in the computer world. They have consistently led by example, largely through by adopting innovative design standards for their products — in response to cofounder Steve Jobs' crucial observation that for the company to succeed, its products would have 'to exhibit qualities that ordinary people could both understand and enjoy'...

Steve Jobs and Steve Wozniak's design philosophy immediately set the company apart from its competitors. Intuitively Jobs understood that a prospective purchaser's response to a product would be determined as much by its appearance and perceived personality, as it would by its inherent technical features. As a result, from the very outset, Apple Computers relied heavily on the application of outstanding industrial design features for all of its products, to set them apart (and above) from those of their competitors.

During the ensuing 22 years, Apple has not only designed the most desirable and user friendly personal computers in the marketplace, but more significantly, they have created an image (if not an illusion on occasions) of design excellence and leadership within a burgeoning industry.

In 1986, Apple integrated LCD displays

into its prototype portable (laptop) computers. From that time on, their products have displayed attributes which have become more attractive than ever. Apart from the time honoured problems, which all manufacturers have experienced with the selection of the most appropriate power source, Apple laptops have proven to be sure fire winners. The LCD technology adopted by the early generation of Apple laptops progressed to colour LCDs and more recently to Thin Film Transistor Active Matrix Liquid Crystal Display (TFT AM-LCD) technology.

Thinking differently

NEVER CONTENT to follow their competitors' more conservative design philosophies, Apple decided that their Studio Display would be strikingly different in terms of both its functional performance and equally importantly its visual impact. From the minute we opened the relatively lightweight box in which the display was delivered, we were instantly aware that this product would exhibit features that would endear itself to us (and potentially to many of our readers as well).

The Apple Studio Display takes the WYSIWYG (What You See Is What You Get) concept to new extremes, for here is a 15" (38cm) eye-catching LCD display encapsulated in a clear blue plastic package, through the back of which the internal electronics is clearly visible. The display is supported by an innovatively designed stand which provides height, angle and skew adjustment of the display to suit most users' predilections.

Not only does the stand provide a convenient place to park your keyboard, but it is so narrow that it takes up less than half the space (depth) of a conventional CRT monitor.

You may wonder why we are reviewing an Apple TFT LCD display in the Challis Report. Well, following the official (main) release of Australian DVD software and hardware in mid September, the demand and peripheral requirements for comfortable home or office DVD viewing has changed significantly. From this point on, a growing proportion of readers will wish to view their conventional DVD players or computer-based DVD compatible drives, with colour displays that are capable of fulfilling multi-functional roles.

What do I mean by that, you may ask? Well, a conventional TV set or video monitor is generally capable of only accepting

one type of input. In like manner, virtually all computer monitors are designed to accept the RGB inputs from Super VGA or similar computer graphics cards. With few excep-

miniature DIN socket for S-Video connections are also provided.

The power supply uses an outboard DC module, which provides 24V DC at 1.87 amps from any supply voltage in the range 100-250V. An adaptor plug is also provided to mate with the 15-pin miniature D socket at the rear of your DOS based computer.

My first step in evaluation involved connecting the Studio Display to my Apple 9500/120 PowerPC computer in place of a conventional Apple 15" monitor. With the normal 640 x 480 pixel resolution, the display was no better than that which I had been using on a daily basis. However with the resolution increased to 1024 x 768, there was a dramatic and exciting improvement in the video display quality, with the characters on the screen cleaner and neater than ever before. When using the full 1024 x 768 pixel resolution, displayed text and numbers with a true seven-point sizing are as clean readily readable as they would be when printed from a good laser printer. That is quite impressive!

I then connected the Studio Display to my 260MHz MMX DOS based computer in place of a Sony Multiscan 200SF monitor, and achieved equally outstanding results, although with both computers I was aware of some perceptible visual horizontal aberrations in the overall clarity of the screen's display.

As a video display

MY NEXT EVALUATION involved a Panasonic Model DVD-A350A second generation DVD player, which I connected directly to the Studio Display's S-Video input. The Panasonic DVD-A350A is an outstanding item of equipment, which not only provides 5.1 channels of audio output but delivers conventional video, S-Video, optical and coaxial digital PC/bit stream audio outputs. Its audio and video quality is impeccable, and it provided an extremely convenient quality source through which I could evaluate the Studio Display's conventional video input capability. I soon discovered there were two routes through which I could connect up the normal video input. Although I thought that this would be achieved by using the S-Video input directly, instead I discovered that I still needed to feed the display monitor from the conventional video output socket on the DVD player. All I needed then were two



A slot at the rear of the stand pillar acts as a guide channel for the main connection cords, to keep them tidy. The front part of the base can act as a keyboard support. Note the display's semi-transparent case.

tions, 'ne're the twain shall meet'...

The problem is that DVD has created a new demand for multi-functional displays, which can satisfy *both* sets of requirements on demand. The advantage of the Apple Studio Display is that it will directly accept video signals from a DVD player, but will just as easily accept an RGB output from either a PowerPC (MAC) or DOS/Windows based computer.

Trying it out

IT'S A SNAP to set up the Studio Display. Power, graphics card, and ADB (Apple Desktop Bus) cables are built in, and Apple includes an ADB-cable extension for use with the Desktop Stand. Full S-video and composite video support is included — compatible with 625-line PAL signals and 525-line NTSC signals as well as SECAM format, which is only of passing interest in Australasia. RCA audio-in sockets and a

The Challis Report

monitor speakers and a small two-channel amplifier. The set-up proved to be so neat, light and convenient that I decided to take both the Studio Display and the Panasonic DVD player away with me for a weekend in the country.

I had available two new DVDs. The first, Columbia Tristar's *Sense had Sensibility*, had been sitting around for almost a month awaiting for an opportunity to be viewed, whilst the second, the same distributor's *Sleepless in Seattle*, had arrived just the day before. Both DVDs proved to be enjoyable, and displayed outstanding visual and audible characteristics.

As I found, both DVDs provide standard two-channel stereo and 5.1-channel Dolby Digital (AC-3) English soundtracks. In addition, both DVDs also incorporate eight subtitle language selections. These languages cater for a wide range of ethnic requirements, which are instantly accessible at the touch of a button on the remote control. All of the languages, including Cantonese, are clearly displayed by the 1024 x 764 pixel resolution. This higher than normal resolution is clearly advantageous, as it easily outperforms some recently released plasma displays which I

A small swing-out door at the rear provides access to the other connectors, for composite and S-video input. The display is compatible with PAL, NTSC and Secam.



have evaluated.

When watching the DVDs (as opposed to a computer output), I discovered that I had to sit within 2 to 2.5m from the screen to maintain a sense a visual perspective. Even at 2.5m the quality proved to be excellent, nonetheless. However, as I moved laterally from a central viewing position outwards from the screen, I immediately became aware of other characteristics which had not been evident during the normal computer assessment. What I observed was a change in the colour balance of the display, which impinges on the visual quality and integrity of the picture. Whilst some people may not be disturbed by this characteristic, others undoubtedly will.

The Studio Display of course has other attributes. The first of these is that it is a low power device, which generates relatively low heat output. In addition if you have been concerned by, or are in any way scared of the electromagnetic radiation potential of your existing monitor, then the Apple Studio Display can immediately alleviate all such concern. In this respect, it would appear to obviate all of the current qualms and problems which I have had with the placement of either my secretary (or me) for extended hours directly in front of a potentially hazardous computer monitor.

In summary

APPLE'S 15" STUDIO Display is a visually exciting piece of hardware. It offers its users an exciting multi-functional ergonomic potential which is hard to assess without actually seeing one. Amongst its more outstanding attributes is its light weight. A further attribute is its display brightness, which is high enough to be used in varying daylight conditions. It is small and light enough to facilitate its convenient repositioning and/or relocation to more distant working or viewing positions (including moonlighting), if and when required.

With a current RRP of \$3300, I don't expect that Apple resellers will have particularly long queues at their doors. Still, I am aware that the price of the Studio Display recently dropped substantially in America. I suspect that a comparable or similar price re-adjustments must ultimately occur in Australia.

At \$3300, the Studio Display will probably prove to be too pricey for most readers. But my impression is that it will out-perform almost any 15" monitor that you can find, and should provide many exciting years of trouble free performance. So when the price falls to a level which more appropriately reflects market needs, it should be very popular indeed. ♦

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Model Used

Apple Studio Display 15"

An innovative flat-screen desktop display with a nominal 38cm-diagonal screen and using TFT AM-LCD (thin film transistor active matrix LCD) technology. Measures 394 x 249 x 375-483mm (W x D x H, adjustable), weighs 2.7kg (stand 2.1kg).

Good points: Futuristic styling, compact, able to provide bright and high resolution (1048 x 768 pixel) images from both Macintosh and IBM-compatible computers, and also composite video and S-video inputs (PAL, NTSC and Secam).

Bad points: Still rather too expensive for many potential users. Not everyone will appreciate the styling.

RRP: \$3300

Available: Apple Computer dealers.



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LISTEN AND YOU'LL SEE

Beyond The Basic Kits

by Jim Rowe

SO, YOU'VE EXPERIENCED the added realism and dramatic 'warmth' of surround sound, with your new Dolby Pro Logic or Dolby Digital (formerly known as AC-3) system, and perhaps your new DVD video player, but now you're wondering about those modest speakers in your 'surround sound starter kit'. Could you get even more impressive results, by splashing out on some higher performance up-market speakers?

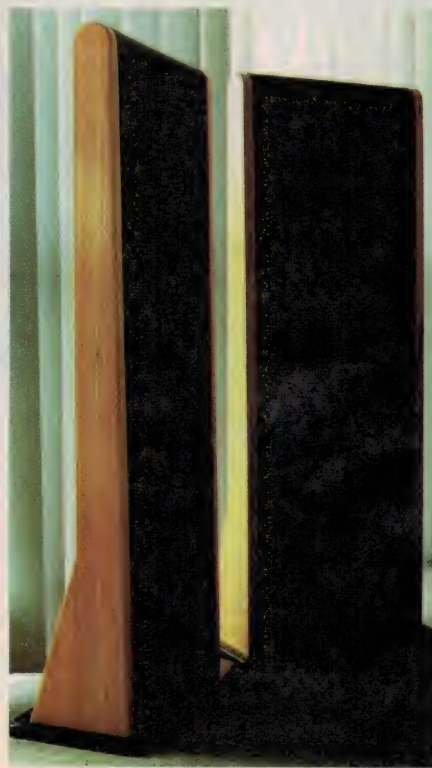
Well, the short answer is that you almost certainly *can* — because when it comes to hifi speakers, that old adage about 'getting what you pay for' tends to apply in spades. Unfortunately, though, price tags alone are by no means an infallible guide to performance or value for money. For a start, not all up-market speaker systems are equal in performance; some have beautifully built boxes made from the most expensive materials, but with internals that are very little better than cheaper systems...

Then there's the 'law of diminishing returns' that you find in many other markets, which also applies here: spending twice as much generally doesn't get you twice the performance. In fact, the further up-market you go, the smaller the incremental improvements tend to get. Once you get to a certain level, your ears may not be able to hear the improved performance delivered by a more expensive system, even if you *can* afford it. (Still, your friends and relatives will be impressed, won't they?)

Mind you, it *is* true that with modern audio systems, the speakers are generally the weakest link in the chain, and therefore the components with the most crucial impact on overall performance. So if you *do* have some extra money to spend, using it to upgrade to better speakers will generally achieve more overall improvement in performance than upgrading any of the other components. So it makes a lot of sense to buy the best speakers you can afford.

Probably the best initial advice we can give, then, is to stick with the well established and most reputable manufacturers. Choose some systems from these that are within your budget, and then try to audition them carefully in turn — either at a friendly hifi/audio dealer, or perhaps in the home of someone who already owns one. Then you'll have a much better idea of the likely benefits for you and your ears.

The performance you can get from today's surround sound systems depends very much on the speakers you use. The speakers in most 'entry level' surround sound packages are generally OK, but if your budget will allow, stretching to some better speakers can almost always deliver added impact and enjoyment. Here's a guide to picking your way through the bewildering choices that are available.



If you like BIG speakers, the Vass Electronics ELS-3 electrostatic system fills the bill. They're 1650mm high...

How about the many different *kinds* of system? Even before surround sound systems came into vogue, a number of different design philosophies and 'architectures' had evolved with traditional stereo hifi speaker systems, each with its own staunch adherents and protagonists (and critics, inevitably). With the coming of surround sound, these different approaches have tended to diversify still further, resulting in such a bewildering range of choices that many potential buyers find it all rather confusing. Especially when just about all of them are claiming to deliver audio perfection...

Of course in the real world, and especially when it comes to speaker systems, perfection is something you can aim for, but should never expect to achieve.

But is any of these different approaches clearly the 'best'? For all users and their needs? Not really. In the hands of a good designer and committed manufacturer, just about all of them are capable of delivering truly excellent performance in a compatible environment. Some are a little more suited to the needs of certain users, that's all.

So in many ways, the kind of system that will be *best for you* depends very much on your individual needs. A brief look back at the way hifi speaker systems have evolved might help to make this clear.

Without a doubt, the most popular type of speaker system for traditional stereo hifi systems has been a pair of fairly large matched boxes or 'enclosures', each designed to provide clear, balanced and faithful reproduction of the widest possible range of frequencies — from the deepest bass right up to the highest treble harmonics. Generally each box contains a number of speaker 'drivers': a relatively large 'woofer' to handle the bass and a somewhat smaller 'tweeter' to handle the treble, plus in some cases a mid-range driver or 'squawker' to handle the middle frequencies. Together with suitable 'crossover' circuitry, to split the audio signals so that each driver handles only the frequencies it's best suited for.

Well designed, this type of two-full-range-enclosures system can deliver superb performance on stereo material. However it isn't easy to design really good full-range enclosures that are *small*; particularly if you want

them to deliver extended bass, and also to deliver enough sound energy to produce satisfying listening levels in larger rooms.

So full-range enclosures of even modest power rating tend to be fairly 'chunky', and hard to make unobtrusive — especially since for best treble response, they need to be out where there's a clear 'line of hearing' to your ears. These characteristics have tended to reduce their appeal for those with limited space, such as apartment dwellers and those who don't find speaker enclosures aesthetically pleasing in the visual sense — wanting their speakers to be 'heard but not seen'.

With the arrival of surround sound and its need for still more speakers to handle the additional channels (centre front and rear left/right), this paradox of performance vs size/obtrusion level has become more pronounced. Although designers of full-range systems have indeed found ways of packing 'more into less', surround sound systems using this approach still tend to appeal more to those with either a relative large listening/entertainment room, where the speakers do become relatively unobtrusive — or to people who are prepared to accept the visual impact of the speakers, and concentrate on the quality of sound they deliver.

For people with either less space, or who just can't accept the visual impact of larger enclosures, happily there is an answer. This is to go for speakers designed according to the other main approach, which uses a 'bass box plus satellites' architecture.

The philosophy behind this approach evolved back in the stereo era too, and was pioneered by firms like Bose. The thinking goes like this: since the bass frequencies are essentially non-directional and virtually the same in all channels (i.e., they're virtually mono information), why bother to generate this part of the sound spectrum in every speaker enclosure? Instead you can use a single reasonably large enclosure to reproduce *all* of the bass, and design this box to be tucked away unobtrusively in a corner. Then your remaining enclosures can be made much smaller and less obtrusive, because they only have to handle the middle and higher frequencies. These compact 'satellite' speakers can be made small enough to slip into bookshelves, or even attached directly to walls.

If you design, manufacture and set up *this* type of system carefully, it too can deliver superb sound quality — especially in smaller listening environments. So it's not surprising that this approach has become even

more popular with the advent of surround sound, and the need for more than two main channels and speaker boxes. Even in a small apartment or unit it's generally not too difficult to fit a single bass enclosure in somewhere behind a sofa (or under a coffee table), and four or five smaller satellite enclosures around the room — without offending anyone's aesthetic sensibilities or making them feel 'surrounded by boxes'.

So these are the two main approaches, both capable of delivering excellent sound but each with its area of best appeal. The full-range enclosure approach tends to be more suited to larger listening environments,



Some of the speakers in British firm B&W's new high quality CDM SE series (L to R): the CDM7SE, CDM1SE, CDM2SE and CDM CentreSE.

and the bass-box-plus-satellites approach more suited to smaller environments. But there are a huge number of 'in between' situations where either approach is equally capable of delivering the goods, and which you choose is largely a matter of taste.

It's also true that nowadays there's no longer a clear line of demarcation between the two approaches — more of a 'grey area' where they overlap quite a bit. For example in producing surround sound speakers some designers have adapted the 'full-range' approach by using a single 'subwoofer' enclosure to reproduce the deep bass (say below about 100Hz), which allows them to reproduce the rest of the spectrum from *relatively* compact 'almost full range' enclosures for the front main, front centre and rear channels...

Hopefully you're now starting to get the idea. Now let's look at a few current examples of better-quality surround sound speaker systems, to illustrate what we've been discussing.

B&W's CDM SE series

BRITISH FIRM B&W has been producing innovative and high quality 'audiophile' speaker systems for many years, and many of its award-winning systems and enclosures are excellent examples of the 'full range' approach. The company's new CDM Special Edition series are a good case in point: a range of enclosures that while scarcely unobtrusive, are nonetheless very elegantly styled and aesthetically quite pleasing. And the sound performance is definitely in the very-little-compromise-here area.

Salient features of the CDM SE series include

rounded cabinet edges to reduce unwanted diffraction of high frequencies; sloping front baffles, to achieve accurate time alignment (vertical lineup of the effective sound source from each driver, so that all frequencies reach your ear at the same time); very high quality drivers, with woven Kevlar cones for lightness and rigidity on the bass and midrange drivers; a fixed bullet-shaped 'dispersion modifier' in the centre of the bass-midrange driver, to smooth its frequency and phase response at the upper end of its range; and improved crossover networks.

There are three main models in the range: the floor-standing CDM7 SE for the main front left and right channels, the CDM C SE for the front centre channel and the stand-mounted CDM 2 SE for the

rear surround channels. Those who want to extend the bass response even further can also add the ASW2000 powered subwoofer.

A set of CDM SE enclosures is certainly capable of reproducing superb surround sound in most medium-size entertainment rooms, for those with the necessary budget. A pair of CDM7 SE's currently have an RRP of \$3395, while the CDM C SE has an RRP of \$1095 and a pair of CDM 2 SE's for the rear channels a further \$1495.

For more information on the B&W CDM SE and other series speakers, contact local distributors Convoy International, at Unit 7, Discovery Cove, 1801 Botany Road, Botany 2019; phone (02) 9700 0111.

JBL's HLS series

ANOTHER HIGHLY respected manufacturer of high-end speaker systems is US-based JBL Inc, which began way back in the late 1920s as the JB Lansing company — famous for making the first sound systems for 'talkie' cinemas. For decades JBL's cinema speaker systems were the yardstick against which hifi enthusiasts modelled their own systems, and they've always been at the leading edge of developments in reproduction technology.

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Surround Sound Speaker Systems

Introduced earlier this year, the new JBL HLS series is a complete family of essentially 'full range' models, based on a proprietary architecture with a 10mm polycarbonate dome tweeter loaded via a constant directivity horn. The bass drivers also use a special co-injection moulded polypropylene cone-and-surround assembly, producing a single seamless component that handles significant bass power with very low distortion.

The HLS series models which are particularly suitable for use in what JBL calls an 'entry level' surround sound system are the HLS615, a floor-standing system suitable for use in the main front left and right channels (RRP \$995/pair); the HLS Centre, for the front centre channel (RRP \$499); and the bookshelf/stand mounting HLS610, for the rear surround channels (RRP \$699/pair). There's also their PSW1000 powered subwoofer, for extending the bass response. For those with a larger budget and/or entertainment room, there's the larger floor-standing HLS820s for use in the main channels (RRP \$1699/pair) instead of the HLS615s. More information on the HLS series and other JBL speaker systems is available from Convoy International, which is also the distributor for JBL.

The Bose approach

THE BASS-BOX-PLUS-satellites type of speaker system was essentially pioneered by Bose Corporation, and under the direction of its innovative founder Dr Amar Bose its engineers have developed the concept considerably. The company's Acoustimass technology has allowed it to achieve low-distortion extended bass from a surprisingly small enclosure, while its latest 'Jewel Cube' satellite speakers are so small that most technical people find it amazing that they deliver the performance they do.

An excellent example of the Bose range is the current Lifestyle 30 system, which is actually complete system including a tabletop control unit with inbuilt AM/FM stereo



JBL's HLS series offer a proprietary Constant Directivity high frequency horn.

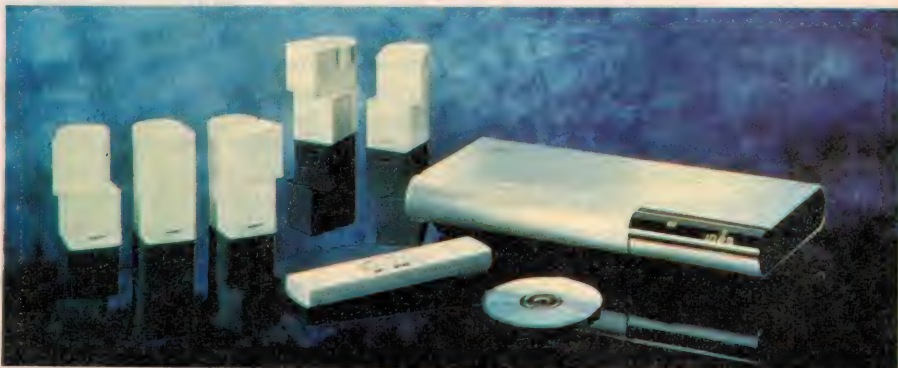
tuner and six-disc CD changer. The power amplifiers are actually in the 'hideaway' Acoustimass subwoofer box, which measures only 587 x 356 x 191mm. The five Jewel Cube satellite speakers are really tiny — 115 x 83 x 57mm, and light enough to mount unobtrusively on almost any wall.

With an RRP of \$6750, the Lifestyle 30 is the flagship of the Bose range, but there are also systems for those on lower budgets. For more information about Bose stockists, call their customer centre on 1800 023 367.

Duntech's Gem series

SOUTH AUSTRALIAN firm Duntech Audio has built an enviable world reputation on its high quality speaker systems, including the Sovereign — regarded by many as the 'Rolls Royce' of speakers, and with a commensurate price to cover the extreme attention to quality and individual testing. However the company has recently released a new range of models called the Gemstone Series, still offering very high quality but at prices that are more affordable.

Very much in the traditional full-range mold, the Gemstone models offer new proprietary drivers incorporating voicecoils wound with Hexatech Aluminium, which achieves an extremely low temperature-coefficient — minimising sound compression at higher listening levels. The tweeters are all hand treat-



Some of the Bose Lifestyle 30 system components. The active bass module is not shown, but normally you get either the white or black Jewel Cube satellite speakers — not both.

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By Duntech



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Surround Sound Speaker Systems

ed soft dome types with large diameter voice coils, immersed in low viscosity Ferrofluid for cooling and damping of unwanted resonances. Great care is also taken with enclosure design and assembly, to achieve accurate time alignment.

Flagship in the Gemstone range is the Emerald system (RRP \$7495), in which each box has a three-way system with two 210mm woofers, two 166mm midrange drivers and a soft dome tweeter. At the entry level is the Ruby system (RRP \$1895), where each box has a 166mm (75mm voicecoil) bass/midrange driver and a 25mm dome tweeter. A pair of Ruby boxes might be used with an Emerald system, to make up an excellent surround-sound system.

For more information on the Gemstone range, contact Duntech on (08) 8347 2666.

VAF's Signatures

ALSO BASED IN South Australia is VAF Research, whose painstaking founder and chief designer Philip Vafiadis is dedicated to achieving speaker systems with the highest possible performance, yet at an affordable price. VAF's speakers have an excellent reputation, and even the lower-end systems deliver remarkably clean and balanced sound. The company is also



Some of the speakers in VAF Research's Signature series, with an I-93 enclosure on the left.

a little unusual in offering many of its systems in kit form, for those who want to achieve 'more system for their money' by providing the assembly labour themselves.

At the top of VAF's current up-market Signature range is the I-93 system, which is very much in the full-range 'no compromise' category. Each enclosure measures over 1500mm high, and uses a three-way system with two 210mm bass drivers, two 130mm

midrange drivers and a 25mm soft dome tweeter, in a symmetrical vertical lineup. The bass and midrange drivers are specially made imported units with phase plugs. As you'd expect great care is taken with cabinet design, time alignment and crossover network componentry, and the results are superb.

The Signature I-93's (RRP \$6750/pair assembled, or \$5950/pair in kit form) would make excellent front main speakers in a top-end surround sound system, with their smaller I-91 as a centre front speaker (RRP

\$1300 assembled) and a pair of compact I-51s (RRP \$2200/pair assembled, or \$1698/pair in kit form) for the rear channels.

For those with a more limited budget, you'd also get very impressive results using a pair of VAF's DC-7 speakers (\$999/pair assembled, \$859 in kit form) for the front channels, a DC-6 for the front centre channel (\$785 or \$685 as a kit) and say a pair of compact DC-2s (\$699/pair assembled, \$599/pair in kit form).

For more information on VAF Research speakers, contact VAF at 291 Churchill Road, Prospect 5082; phone 1800 818 882.

Vass electrostatics

A SOMEWHAT DIFFERENT approach is taken by Victorian manufacturer Vass Electronics, which produces a series of wide-range electrostatic and hybrid electrostatic systems. These would mainly be used in the main front left and right channels of a surround sound system, with other enclosures used for the remaining channels.

(Instead of electromagnetic cone-type drivers to produce sound energy from audio currents, electrostatic speakers use fairly large but very thin membranes, suspended between perforated high-voltage electrodes — essentially a large capacitor with a 'vibrating dielectric'. When they're well designed, this can result in very even distribution of sound energy over the entire membrane area, and very smooth 'transparent' sound. But a special wideband high-voltage transformer is usually needed for matching to the amplifier, as well as a high voltage power supply.)

The new Vass ELS-3 system is a full-range system with fully electrostatic drivers, covering the range from 60Hz to 20kHz. Each speaker unit measures 1650 x 660 x 380mm and weighs 50kg. With an ultrathin diaphragm film used it's claimed to produce exceptional clarity and rapid transient response.

For surround sound systems the ELS-3 system (RRP \$7980) could be supplemented with conventional cone-type speakers for the centre front and rear left/right channels. A subwoofer could also be added to extend the bass performance.

For more information contact Vass Electronics at 1/42-44 Garden Boulevard, Dingley 3172. ♦

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This infra red compact keyboard features 86 keys with Win 95 104 key functionality. It features membrane keyswitch with tactile feedback, an effective

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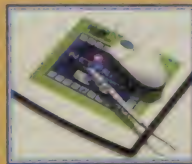


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Scanner Turns Your Printer into a Copier

Need a photocopier for the home office? If you already have an HP-compatible printer for your computer, the new Avision ScanCopier will turn it into a flexible copier — at surprisingly low cost. As a bonus, it also works with your PC as a standard 300 x 600dpi colour or greyscale scanner...

by Jim Rowe

A PHOTOCOPIER is almost mandatory nowadays in most small business and home offices, but even the cheapest self-contained models are still fairly expensive — in terms of both initial and running costs. Often they're pretty limited in terms of functions, too; models that offer reasonable-quality greyscale reproduction and decent zooming (enlargement/reduction) range tend to be much more expensive.

Of course if you already have a decent laser or inkjet printer, as a peripheral for your PC, this means you already have the 'output' half of a copier. In effect all you need to complete the copier is the 'other half', essentially a scanner plus some intelligent control and scaling electronics.

Realising this, some of the scanner suppliers (like HP) have provided a software 'copier utility' with their recent models. And these often work fairly well, but only with that manufacturer's own scanners and printers. There's also the complication that you must have your computer running to make copies, and in many cases you can't run other programs at the same time — the copier program needs all the processor power and working memory it can get.

Presumably with these kinds of consideration in mind, Taiwan-based OEM scanner manufacturer Avision has come up with the ScanCopier, a novel low-cost unit that's both a conventional colour scanner and also the 'front half' of a photocopier. In fact you can make greyscale copies simply by hooking it up

directly to a PCL-compatible printer; no computer is needed.

The ScanCopier is only slightly larger than a modern A4 scanner (457 x 356 x 91mm), with a scanning area of 356 x 216mm (14" x 8.5"). The main obvious difference between it and a scanner is the copier-style control panel, with an LCD screen and buttons for selec-

Avision ScanCopier

A low cost graphics scanner which can also drive a PCL-compatible printer directly, to function as a photocopier.

Good points: Very easy to get going as a copier; good copy quality; zoom range from 25% to 200%. Comes bundled with a nice suite of scanning, OCR and document management software.

Bad points: Not much, especially considering the price. A couple of front-panel buttons seem to have no real purpose.

RRP: \$499

Available: InnoVision Group, 174 Corio Street, Shepparton 3630; phone (03) 5831 8833.

tion of copy quality, copy density, number of copies, reduce/enlarge, zoom factor, background removal, paper size and so on.

Interfacing with a PC is via the parallel printer (ECP/EPP/SPP) port; in fact the ScanCopier is intended to be connected between the PC and the printer in 'daisy-chain' fashion, so it can drive the printer alone for straight greyscale copying, or operate with the PC as a scanner (using the driver software supplied). In fact part

of the bundled software supplied is a copying program, so if you have a colour printer this allows the PC-ScanCopier-Printer combination to operate as a colour copier as well.

Applications software bundled with the ScanCopier includes MGI PhotoSuite for image scanning and manipulation, Xerox Textbridge for OCR, and PaperCom for electronic document management.

The ScanCopier's capabilities as a semi self-contained copier are quite impressive. There are a total of six pre-set enlarge/reduce settings in addition to the 100% default, giving enlargements of 115%, 122%, 141% or 200%, and reductions to 86% or 50%. Alternatively you can select any zoom factor between 25% and 200%, in 1% increments. There's also an 'Auto Zoom' setting, which automatically scales smaller originals up to the paper size in the printer. The Paper Size button allows you to choose from either A4, Letter or Legal paper, depending on what you're using in the printer.

There are two selectable 'copy quality' settings, Normal (300dpi) or Quality (600dpi), while the number of copies can be set to any figure between 1 and 99. There's also a 'Lighter/Darker' button, with a pair of



Up/Down buttons to select the desired density from a bar graph displayed on the LCD screen.

You also have a 'Background Remove' button which invokes a function which 'cleans up' copies from originals with a back-

ground colour.

Three further buttons are provided, one being the Scan button used to initiate scanning with the bundled PC applications.

The other two are marked 'Select' and 'Printer Select', and currently neither seems to do very much. At present the ScanCopier only works directly with printers compatible with Hewlett-Packard's PCL graphics language, so there really isn't any other choice.

Mind you, many recent printers from a variety of manufacturers are PCL compatible. Quite apart from HP's LaserJet series, they include Fujitsu's PP series, Canon's LBP series, Epson's EPL and Action series, Lexmark's Optra series, Oki's OL series, Panasonic's KX series,

Brother's HL series and Kyocera's FS series — quite a broad range. So there's a pretty reasonable chance that your printer will be among them.

Power for the ScanCopier comes from a small plug pack, as the consumption level is only 15 watts when scanning/copying.

Trying it out

WE WERE MAINLY interested in trying out the ScanCopier as a copier, directly driving our HP LaserJet 4m printer. And it turned out to work quite well, delivering copies almost as speedily as our fancy \$15k-plus office copier, and with copy quality that was quite acceptable — especially when you consider the price.

There was a small amount of 'banding' on the copies initially, visible mainly on the white background areas. However we managed to get rid of most of this by experimenting a bit with the 'Copy Quality', 'Background Remove' and 'Lighter/Darker' functions.

The ability to zoom to any copy scaling between 25% and 200% is very nice, although perhaps a little limited at the low end by the limited original scanning area of 280 x 216mm. Still, it's about as versatile as you can get from a device taking up such a modest amount of desktop 'real estate'.

The bundled software supplied with the ScanCopier is quite reasonable, and should allow most home and small business users to achieve pretty well all they want in the way of image scanning, OCR of documents, PC-based faxing and other similar tasks.

In short, then, the ScanCopier seems a very practical little unit and quite good value for money. If you already have a decent PCL-compatible printer for your PC, it should make an excellent way to give yourself a flexible low cost copier as well as a scanner. ♦



The connections at the rear, which allow you to hook up the unit in the PC's printer cable, in daisy-chain fashion.

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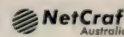
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Home truths about G-code, DVDs and local manufacturing...

Why shouldn't we be too surprised that the TV broadcasting schedulers aren't all that worried about sticking to their program times as encoded in published G-codes? Or that there's still only a rather pathetic range of video DVDs available in Australia, compared with the USA? These are two of the points taken up by our first correspondent this month.

IN THE AUGUST issue, you may recall that we published a letter from reader and occasional contributor Dave Jeanes, complaining about some of the shortcomings of the G-code system for simplified programming of home VCRs — especially in areas like the Gold Coast. My own 'leader' was on the topic of DVD video discs, and the rather pathetic range of titles available here as yet.

Well, as I mentioned last month, another reader has written in to make interesting and thought-provoking comments on both these topics, and to some extent take issue with both Dave Jeanes and myself. I didn't have room to present his letter last month, so we'll do so now. The reader concerned is Mr Keith Anderson of Kingston in Tasmania, and without further ado here's what he has to say:

I was intrigued by the juxtaposition of two seemingly unrelated items in the August 1998 issue of Electronics Australia: the letter from Dave Jeanes complaining that G-code is of disappointing benefit; and the editorial by Jim Rowe worrying that DVD might suffer infant mortality. I think that both concerns can be explained by a simple understanding of the hurly burly of what leads to commercial success in this modern world of dog-eat-dog competition — and the prediction is that Dave and Jim are right.

All business managers are motivated to obtain a competitive advantage for their business and to deny competitive advantages from their competitors.

Let's think who is motivated to make G-code work well, and who is highly unmotivated to see it work well. One obvious group is consumers: us. We welcome anything that enables us to program our VCR reliably without first becoming the Dungeon of Doom Grand Wizzard at level 11. Because we want it, VCR manufacturers are motivated to invent it and to sell it. Because they want us to read their magazines, magazine publishers are motivated to publish the G-codes.

But what about the TV broadcasters? It is tempting to think, "Well, they want us to

watch their programs, so they should be motivated to schedule their programs accurately so the G-codes will work reliably". Ah — that's the catch. TV broadcasters don't want us to watch their programs — they want us to watch their sponsor's advertisements.

Although we claim to use recording only for time shifting, TV broadcast managers aren't dills. They know that almost every VCR on the planet has a remote control with a fast forward button; and they know that almost every viewer will press that button at the start of the sponsor's message, and release it when the program resumes. That is exactly the opposite of what the sponsor, and consequently the TV broadcaster, wants us to do. We shouldn't be the least teeny weeny bit surprised when they 'accidentally' let a program run on a little longer than advised to the magazine publisher.

It isn't hard to imagine just how upset and cross the broadcast manager must be when this happens: "Gee shucks! all those people using G-code will have missed the 'whodunnit' or the 'riding into the sunset' happy ending; tsk tsk, what a shame. I must reprimand the scheduler, very severely; I want him in my office first thing Tuesday morning — 17 August 2004".

It isn't an accident that the ABC is able to keep to its published schedule much more accurately than the commercial broadcasters. But even the ABC does this less accurately now than in the olden days, before the VCR became commonplace.

Passenger: "What is the use of publishing time tables when the trains are always late?"
Station Master: "If we didn't publish time tables, how would you know they were running late?"

One day, while musing on ways to make my fortune, I hypothesised that what customers really need is for the G-code to be transmitted as part of the broadcast. I also contemplated intermediate codes for the start and end of the advertisements. The VCR would then match the G-codes, recording when a

programmed G-code was being broadcast, and stopping when it wasn't, including stopping during the advertisements.

I am smart enough to realize that broadcasters would not cooperate with this one little bit, and decided that what I'd need would be real live humans watching the programs and pressing buttons to transmit the codes from my own transmitter. With modern cell-phone like coding technology, it could probably be done with a very low power, low bandwidth transmitter, and there are probably few technical difficulties.

I do anticipate two non-technical problems: during boring programs, the humans will fall asleep and forget to press the buttons; also the TV broadcasters can afford much more expensive lawyers than I can.

DVDs more complicated

THE DVD ISSUE is a little more complicated. The difficulty here is that each of several large electronics companies wants to become the Microsoft or Intel of the hifi industry. But no one gets to dominate an industry by agreeing to accept someone else's standard, or even a general communal standard. Instead, domination comes from inventing something different, not necessarily better, and hoping that your way of doing it catches on and becomes the defacto standard.

We shouldn't knock this. It is often very lucrative — consider VHS, Dolby, THX. I haven't done a thorough business analysis, but the sort of thoughts a manager needs to think are: "If I go for world domination, there is a 10% chance I will succeed; there is a 80% chance I will be no worse off than I am now; there is a 10% chance I will be worse off. If I go for cooperation, there is no chance I will achieve world domination; there is a 50% chance my market share will increase; there is a 50% chance it will shrink". It isn't a difficult decision...

Cooperation is the preferred strategy only in special and unusual circumstances. We need to recognize and admit that the introduction of the Compact Disc was unusual,



verging on rare. Although it was good for consumers, and although it made a lot of money for Philips and Sony, it also made a lot of money for their competitors, and they still have competitors, and they still risk that the next wonderful invention will be made by someone else, who is probably hoping to dominate the market.

I can easily imagine that in the boardrooms of Philips and Sony the CD is seen as a bit of a flop and the decision to cooperate with one another and with the rest of the industry is seen as a really dumb move that no one will be game to suggest again for decades.

I think it isn't necessary to pine too much for a technology that struggles and whithers. I remember the days of quadraphonic sound. There were at least three different ways of doing it. None was an obvious winner. None succeeded. Although many people were disappointed at the time, I think hindsight reveals that it was not a great loss. Once something obviously better came along, it did succeed.

I think the DVD might well be in the same situation. The fact that there are several ways of doing it is a hint that none of them is an obvious winner, and that is a hint that maybe none of them deserves to succeed.

Alternatively, the DVD might be before its time. It might be that we need things like the NEC PlasmaSync 4200W, mentioned briefly

on page 13, to become available for under \$1000 before any improvement in video recording technology becomes important.

Thanks for those comments, Keith. I for one found them very interesting, and the points you make seem to be pretty close to the truth — or at least part of it. I'm sure you're right that the TV broadcasters and their advertisers aren't all that keen on G-code, and for fairly obvious reasons as you say. The whole impetus for G-code (and VCRs, for that matter) came from VCR marketers and (ultimately) viewers, after all.

I daresay you're right about the conflict between commercial success and industry standardisation, too, although as you say the situation involving DVD video discs is fairly complex. I'm sure that it's commercial factors rather than technical factors, as you say; but there seems to be another — related — conflict, between the desires of hardware makers to maximise their profits, and those of the big movie producers wanting to maximise theirs.

Presumably the makers of DVD players would prefer there to be no regional coding, so they wouldn't have to make so many models customised for each of the regions. They'd probably be able to sell them for a lower price, as a result, and they'd probably sell more of them — and sooner rather than later, because the growth of the global software market would be faster.

On the other hand the movie producers stand to gain a lot more from the regional coding system, because it allows them to control the release of their products a lot more tightly in each of the markets, in each of the regions. If that means that availability and sales are slowed down in some of the minor markets like Australia, well so be it...

How this kind of conflict is resolved in a company like Sony, which straddles both sides, I don't know. Perhaps it depends on which side of the global organisation makes the largest profits.

Were we both right?

YOU AND I may both be right, though, that the end result of this somewhat cavalier market manipulation may well be that DVD may end up as another product that never quite 'makes it' here in the consumer market — like quadraphonic sound, or Mini Disc, or DCC. At the very least, I suspect it'll take quite a while to get going...

I guess you're also right about 'market forces' determining the success or failure of these developments, and that we shouldn't bemoan the fact that only the 'fittest' survive. Still, from the technical viewpoint DVD does seem so much better than video cassettes as a medium for distribution of movies for the home viewing market; I for one will find it hard not to feel a bit disappointed if the bean counters strangle it.

Making it here

MOVING ON, though, you may recall that in my leader in the July issue, I commented on the differences between Silicon Valley and Australia, in terms of electronics and semiconductor manufacturing — bemoaning the way we compare so dismally, and asking why things had been allowed to slide so far.

There have been a few letters following up on this, like the one from Mr T.A. Mowles that I presented last month. Here's a second one, which came from Mr Alan Tunnah of Sanctuary Point in NSW:

Your most pertinent Editorial, in your July 98 issue of EA, subsequent to your visit to the USA to see for yourself the advances in the field of electronics, with continued advances in high-tech electronic engineering and manufacturing processes, was most timely. That you felt the need to ask the question "Why Can't We do it Here in Australia" was nothing less than a National disgrace, for there is no reason on earth why we here in Australia could not have done the same — or a lot better.

For decades — 40 years at least, Australia has lagged behind more far-seeing nations like the USA and Asia in electronic technology and manufacture. Some firms here in Australia did attempt to compete with the Asian industrial juggernauts; witness one company, a household name here, and known the world over. Where is it today? It is part of the gambling industry! It just could not compete with the cheap labour costs in Asia. That is also why today, many Australian firms send their manufacturing of electronic equipment overseas to Asia and re-import the finished products for sale here. Whilst unemployment continues to rise and there is no work, so Australians are put on the lengthening dole queues!

Governments should stay out of business, but governments ought to make the conditions here suitable and available for Australian industry to be self sufficient and export all manner of goods. The Asian economic collapse should be a salutary lesson to government not to place all their eggs in one basket. It's time the ability and know-how of Australians was employed to the full, with real jobs, not washing down aeroplanes or whitewashing stones.

What is also an indictment in your report is on the numerous politicians (of both persuasions), who week in and week out, trot off overseas on so-called 'fact finding tours', at the Australian tax-payers expense! Obviously they ignore, or turn a blind eye to what they should be seeing; or more likely, they just do not understand that they are looking at. For, once back in Oz what do they do? They invoke something they call 'economic rationalism', by sending work that should be done in Australia up to Asia,

to be done at cheap labour costs, and put more Australians onto the dole queues! That is Economic Irrationalism!

Just a brief look through any electronic engineering catalog shows that around 95% of the electronic components and equipment are produced in Asia. Walk through any large store, and there are all manner of goods all manufactured in Asia! The total dependance on Asia, fostered by government, is quite wrong. Indeed the collapse of Asian economies is now having no small effect on our economy as a result.

You mentioned in a previous article the lack of good electronic engineering and technical staff; you were quite correct. Take a look in the Sits. Vac. column for electronic staff, you will be lucky of there is more than the fingers on one hand and sometimes even less! Such staff are an endangered species, and are almost extinct.

Of course technology itself has dispensed with many, as the very long reliability of electronic solid state devices means that not as many are required to repair equipment. And where this is necessary, the simple replacement of a complete PCB is often all that is necessary. In some cases, it's cheaper to purchase new equipment. I heard of one person being asked \$60 just for a quotation to repair a computer!

Again, as you have previously mentioned, technical information on most equipment is not freely available. One may purchase a workshop manual for a vehicle, but not for a computer, TV, etc. There is nothing secret today about most electronic equipment, so why the mystery? Even in computers fuseable resistors are often used, quite inaccessible to most, which means it has to be taken to a dealer for repair.

Years ago, many commenced their careers in electronics through a keen interest in amateur radio. However today, 'home brew' equipment is rarely seen, and not many youngsters can afford the thousands of dollars to set up an amateur radio station. Even the government stick up their licence fees, whilst giving the TV media moguls free, the section of the frequency spectrum allocated for digital TV services! 'To those that have shall be given — to those that have not, shall be taken away'. Is it any wonder that the electronic genus has declined, and will continue to do so?

The establishment of a viable electronic industry here in Australia, as you mention would be very costly, particularly with the possibility that by now we have 'completely missed the boat'. However if this nation of ours is ever to become self sufficient, then it will have to be met, even at this late stage. No one can predict the future; would it not be wise to cater for any eventuality?

Sadly, this question of a thriving viable

electronics industry here in Australia will probably not progress beyond much talk. If this nation has taken at least 40 years to try and decide where to put Sydney's second airport — without success — no one had better hold their breath hoping for a miracle!

Hmmm — thanks for those comments, Mr Tunnah. You make quite a few points, and on the whole you seem to be in broad agreement with what I said in the July leader; so I suppose it's not surprising that I found myself nodding in agreement, in various places! All the same, I'm not sure I can agree with you in all respects — perhaps because I don't think there are any simple and clear-cut answers; it's too complex.

For example it's all too easy to blame the politicians, and conjure up conspiracy theories to explain why they haven't done what we believe would have been right. But as someone fairly wise once pointed out to me, most disasters are more easily explained as the result of ignorant stuff-ups than deliberate conspiracies and malevolence!

Although the majority of our politicians do seem to be pretty dumb when it comes to technology and/or economics, when it's all boiled down they're probably no worse in this regard than the polities in most countries — like the USA, for example. And the reality is that they're basically guided by bureaucrats anyway, in the same way that polities are in those countries too.

Does that mean we should blame our bureaucrats? I suspect that would be being overly simplistic, too. I imagine the bureaucrats gave their advice on the basis of what they genuinely believed would be in the best interests of Australia; presumably it was somehow thought that we'd only be able to sell our wool, wheat, coal, iron ore etc (Australia's traditional 'export base') if we let most of our high-tech manufacturing quietly roll over and die...

You mention an Australian firm that was for decades a household name, which is now part of the gambling industry — and note that it 'just could not compete with cheap labour costs in Asia'. That many have been a part of the firm's problems, I suppose, but my impression is that the causes of its unhappiness (not to say tragic) downfall were pretty complex. I've heard references to inert and inept management, failure to invest in up to date production equipment, and of course their unhappy activities in the area of futures and currency trading.

Let's face it, though. The firm concerned was building first-class products in many high-tech areas where competition from 'cheap labour' really wasn't a problem. If they'd played their cards right, it's hard to see why they couldn't have survived and flourished into the next century.

On the other hand, most of the local firms who were competing with them in their heyday aren't around anymore either, so again there's probably more to it... But that's about all we have space for, this month. ♦

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ELECTRONICS

Low cost

Oatley Electronics are currently selling network cards for PCs at just \$30 a pair, so we thought we'd have a go at setting up a LAN at home. With Windows 95, it turned out to be a lot easier than it looked...

by Jean-Baptiste Cattley

ANYONE WHO has ever used floppies to transfer files between two computers, played deathmatch Quake at work (after hours!) or lugged the printer from room to room obviously needs their own LAN. Suggest this to most people, however, and they turn pale and run from the thought of wrestling with DHCP servers, packet drivers, IP header compression and suchlike horrors.

This is a shame, as setting up a small peer-to-peer LAN on Windows 95 is ridiculously simple. The whole process takes about an hour, and the benefits are enormous. You can run programs and edit files located on another computer, access drives and printers in the next room, and exchange files, documents and rocket-propelled grenades.

What you get

OATLEY ELECTRONICS currently supply a pair of DEC EtherWorks LC/TP network cards, complete with manuals. You need to supply your own twisted-pair Ethernet cable, and unless you have a hub (necessary if you want to connect more than two computers together), you'll need to do a little surgery on the cable, swapping around the transmit and receive lines. This only requires crimping on a new plug, or a quick job with a soldering iron and PVC tape (Oatley supply full instructions), so it shouldn't present much of a problem for the average *EA* reader.

The cards use 10baseT connectors, which can carry up to 10 megabits/second over a maximum length of about 180 metres. If you want to install live video conferencing for your entire suburb, it may not be the system for you. But for the average home or small business user, it can easily handle anything you're likely to throw at it.

Setting it up

I INSTALLED a pair of cards in the two machines I have screwdriver access to: a K6/2-300 with 64MB of RAM, and a

Pentium 150 with 32MB. Installing the cards was more or less painless; the hardest part of the whole exercise was finding a free IRQ for the cards to use. The cards only take one 8-bit ISA slot, one IRQ, 16 bytes of I/O space and 32 or 64KB of memory — surprisingly frugal for a peripheral these days.

All of these resources can be reallocated with the DIP switches on the cards. Although the cards themselves are not PnP compliant, you get a good enough range of alternatives that fitting them into any given system is no problem. I actually had to sacrifice an extraneous COM port on one of the machines to free up an IRQ, but that computer had a PS/2 mouse anyway.

Once the card was physically installed and Win95 was rebooted, running the Add Hardware Wizard found the card straight away, and installed all the necessary drivers straight off the Win95 CD. From there, all that was left was to install the actual networking components for Win95 itself. Win95 supports a number of protocols, with IPX being perhaps the simplest to implement. I just selected the IPX protocol from the list, and Win95 did the rest. There

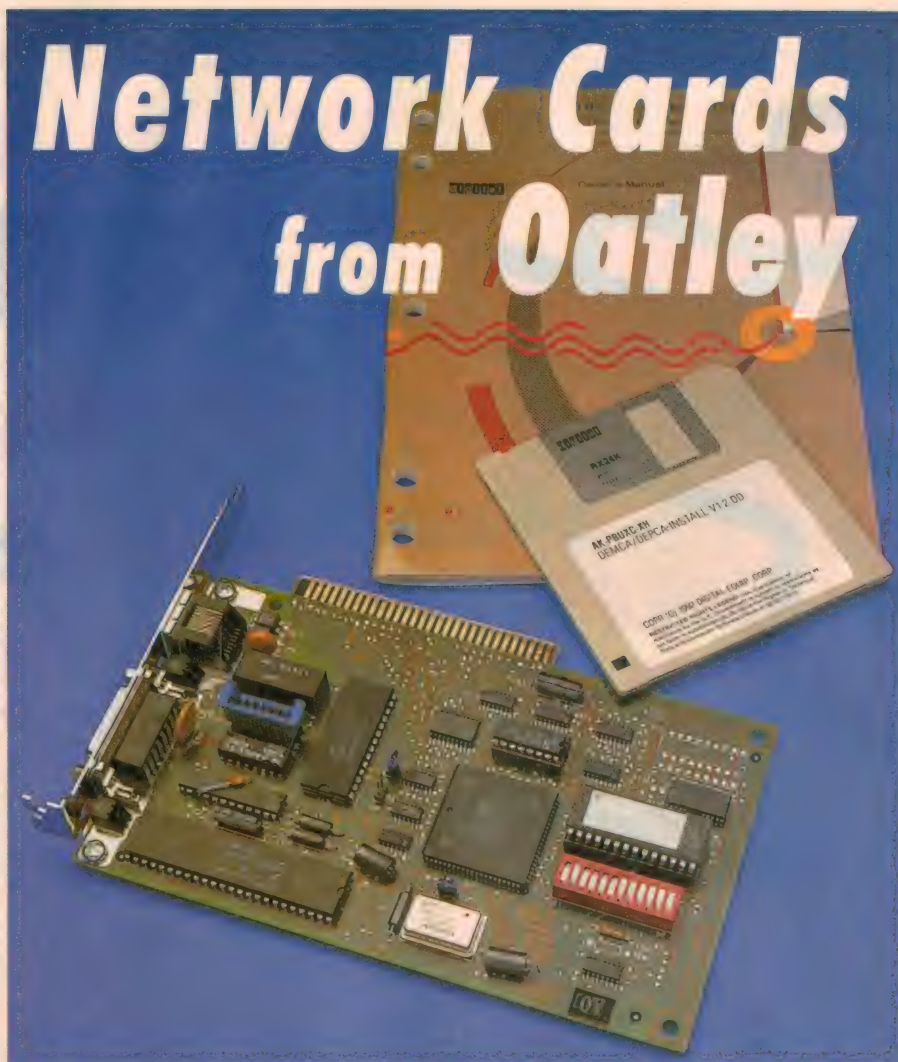
are virtually no options to get wrong, so it just works straight off.

Setting up the whole network with file and print sharing took about half an hour all up, and at the end of the process both computers could access each other's drives and print to each other's printers as though they were their own.

Performance

ORDINARY FILE management and document access over the network was fast enough to be completely transparent. Even on very large files, data transfer rates were quite respectable: copying a 30.186MB file from one computer to the other took 65 seconds, which works out at about 460KB/second. This won't exactly shame your average hard drive, but if you compare that with a Laplink cable, or even — horrible thought — floppies, you'll start to appreciate just how useful a network can be.

Of course, you wouldn't set up a whole network just to copy a couple of files across, but if only one of your computers has a CD-ROM drive, for instance, the convenience factor would pay for the whole setup in 10



minutes flat. Another place a network comes in handy is if only one computer has access to the Internet — but to really take advantage of that, you need to have...

Fun with TCP/IP

AS WELL AS the boring but effective IPX protocol, there are a number of interesting things that can be done with TCP/IP, the underlying language of the whole Internet. TCP/IP is a little bit more involved to set up than IPX, but it really all boils down to choosing a unique IP address for each card from the pool of addresses allocated for private networks. Once you have that set up, you can run all sorts of interesting Internet applications, such as a web server for your own personal Intranet, or more interestingly, a proxy server such as WinGate or VSOCKS Light.

As I recently mentioned in my Computer Clinic column, a proxy server allows you to connect two computers to the Internet with only one modem and one Internet account. If you have more than one person who needs net access, this is by far the most efficient way to do it. No matter how fast your modem, at least half of your connect time these days is spent waiting for data to actually get to your ISP's server. If two people share the connection, you can effectively get twice as much done in the same time.

Summing up

HAVING A NETWORK installed increases the scope and flexibility of your systems to an amazing degree. The cards from Oatley Electronics are brand new, cheap, fast enough, and they work. If you can tell an IRQ from a hole in the ground, and you aren't afraid to use a pair of wire cutters, then I can thoroughly recommend these cards as a cheap, quick and effective way to get an 'instant LAN'.

By the way although we were only able to try them with Win95, they should also be quite compatible with Windows for Workgroups 3.11, and almost as easy to get going. ♦

DEC Network cards from Oatley

Good points: Fast and simple way to set up a peer to peer network; cheap too!

Bad points: None to speak of, but you will need a spare IRQ and have to dig up a spare network cable.

RRP: \$30.00 for the pair.

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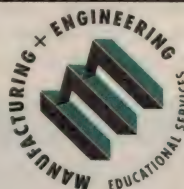
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Computer Clinic

Buggy BIOSes, haunted hard drives and taking the MS out of DOS...

Lost a boot

My computer has been running Windows '95 for a year or so with few problems. However recently it has been coming up with the message 'Boot disk error, insert system disk and press return' when I switch on the computer. Doing this solves the problem, but the same thing happens every time I switch it on.

Instead of inserting a system disk, I now switch the computer off for a few seconds when the message appears and then switch it on again, whereupon all proceeds smoothly without using the system disk at all. If I reboot the computer within about 15 minutes after switching off, it boots normally; any longer than this and the 'Boot disk error...' occurs again. I tried FDISK /MBR, but this did not help. I assume there is something wrong with the boot portion of my hard disk; how can I fix this problem? (Bruce Howard, by email)

First up, this sounds like a hardware problem, not a software one. If you have a virus

or boot sector glitch that can tell how long the computer has been turned off, you don't need tech support, you need an exorcist. There could be a number of things wrong with your drive, but for my money, you've got a thermal problem. Not your usual, common or garden excess heat build-up kind of thermal problem, but the much harder to track doesn't-work-in-the-cold type.

One of the monitors I use is afflicted by this; if it is left turned off on a cold night with the window open, the vertical oscillator refuses to work for a good 10 minutes after I turn it on again. These 'thermosetting' faults can be caused by a bad solder joint or cracked PCB track that has sprung apart a few hundred microns, and only makes contact when thermal expansion pushes it back into place.

Unfortunately, there is not a heck of a lot you can actually do to fix this. You could make sure that all the connectors are firmly seated, and maybe try replacing the IDE cables, but apart from that you're more or less down to giving the thing a hot water bottle overnight.

The other possibility that springs to mind is that the bearings on your hard drive might be getting a little worn. If this is the case, the drive motor might have to overcome some degree of static friction, and take a little too long to spin up from a full stop. Consequently, it might not reset in time for the POST check, causing the BIOS to run round like a headless chicken screaming that your drive is broken.

On subsequent reboots, the motor would still be spinning or at least not settled back down again, and thus work perfectly well. Once again, this isn't exactly a healthy prognosis for your drive. Mounting the drive in another orientation inside the case can sometimes help, but in my experience once a given piece of hardware starts to change the way it behaves, its days are numbered. If I were you, I'd back up any important data you have on that drive, and be prepared to find a new one in the not-too-distant future.

One last possibility is that your floppy drive might be sporadically detecting a floppy when there isn't really one in the drive.



I like DOS, but...

The basic structure of MS-DOS, upon which all subsequent versions have been based, was developed back in 1981 over the course of about six weeks, and has afflicted defenceless PC users ever since. Luckily, a cure has been developed in the form of replacement DOS shells. These replace COMMAND.COM as your command inter-

preter, and provide many interesting alternatives to the world's most popular computer joke — from straight-out clones to complete ports of the UNIX C shell.

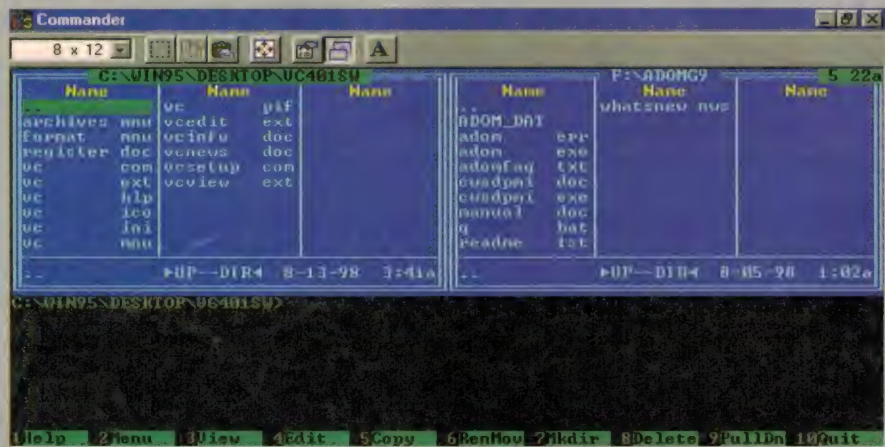
Browse on over to <http://ftp.simtel.net/pub/simtelnet/msdos/sysutl> and check out what's available. You'll want to download a copy of **00_index.txt**, as this contains all the file descriptions.

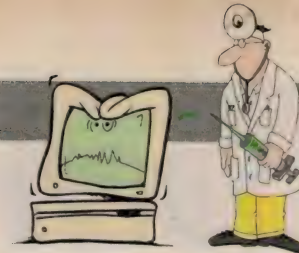
Perhaps the most famous DOS replacement is 4DOS. 4DOS boasts a range of features, including history editing, vastly

improved batch file commands with string and number handling, aliases and about 50 other commands and features. If this sounds like your cup of tea, download a trial copy at <http://www.jpsoft.com/>. 4DOS is shareware, and requires a \$69 registration if you continue to use it. A little pricey, perhaps, but extremely useful all the same.

If you don't mind COMMAND.COM, but are tired of the old CD - DIR - CD - DIR... routine, what you need is a graphical file manager, such as Symantec's Norton Commander, the most useful DOS program ever written. This is a commercial product, but is worth every cent of its \$109 price tag. If you aren't lucky enough to own a copy of this gem, get yourself a copy of Volkov Commander, available at <http://come.to/volkov>. VC is an almost perfect clone of Norton's, and the shareware registration is only \$20.

For dozens of other file managers and related utilities, check out <http://ftp.simtel.net/pub/simtelnet/msdos/fileutil>. Once again, you'll want to download a copy of **00_index.txt** to see what all the files actually do. Of course if you want to try out a full-bore command line interface, you could always install Linux... ♦





Got any computer queries? Whatever is bugging you, from hardware problems to C programming, send it in and we'll soon have you fixed up. You can email your question to electaus@magna.com.au, or fax or mail it in to us here at EA.

Due to some unfortunate laws of physics, it's impossible to boot off a non-existent floppy, and thus your system complains. Try disabling floppy boot in your CMOS setup (usually under Bios Features in the setup menu — hit DEL as you reboot) and see if that helps matters.

CMOS screw-up

Just last week I added a Samsung 6.4GB hard drive to my computer, as a slave drive to my Connor 850MB drive. The computer has an Award Modular BIOS v4.50pg with a plug and play extension V1.0a.

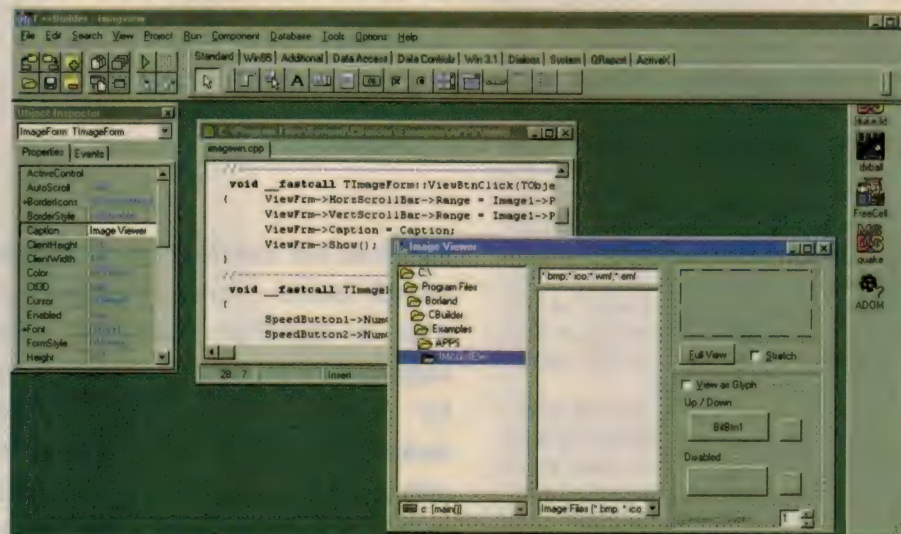
Using Auto Detect, the BIOS suggests settings which are different from those of the HDD. For example, it suggests 789 cylinders and 255 heads, whereas it should be 13424 cylinders and 15 heads. The size is also wrong — it says 147MB.

The thing is that this setting works! I can use FDISK to partition the drive and then format it, ending up with about 6.2GB, even though upon booting the BIOS tells me the drive is only 147MB. When I manually typed in the correct information to the BIOS, it registered the drive as being about 500MB and when I used FDISK, I could only partition it to this size.

Can you explain this situation and suggest a way to get the BIOS to show the right size? I thought that perhaps the BIOS was too old to recognise a HDD of this size, but the mainboard manual says it can handle IDE drives up to 8.4GB. (Andrew Mason, Toowoomba Qld)

Good news: Your computer is only halfway loony. The reason that it shows a seemingly incorrect number of heads and cylinders is because it is running the drive in LBA (Logical Block Addressing) mode. LBA is a work-around that allows the BIOS to overcome the inbuilt limitations of the standard CHS (Cylinder Head Sector) addressing scheme.

Due to a stunning bit of foresight by the original designers, the standard CHS scheme is limited to 16 heads and 1024 cylinders, leading to a maximum total size of 504MB. With LBA addressing, however, the BIOS effectively lies to the operating system about the number of heads and cylinders available, giving up to 255 virtual heads, and as many virtual cylinders as are necessary to add up to the right size. The BIOS then translates requests for a given cylinder/head/sector from the operating system into a 28-bit sector number, which is then passed on to the drive controller for conversion into the actual physical location on the drive.



If you are looking for a visual C++ environment that doesn't require 37 years of digging through Microsoft's Visual C++ installation, then try out C++ builder. I got a 'Hello, World' up and running in under a minute...

C++ made easy

In the last couple of issues, you commented on the topic of 'beginner's programming'. You mentioned a couple of packages (Visual C++, Basic, Delphi), and lamented the lack of a simple C++ programming environment. Well, Borland have developed an excellent 'visual' environment called C++ Builder. It's basically Delphi, but with C++ instead of Pascal. The Standard package cost me about \$130 (student price) and came with a couple of real-as-in-you-can-actually-read-them-in-bed books. (Ben Low, by email)

At the time of writing, I hadn't actually had a chance to play with C++ Builder, but since trying out the 'Lite' version, I would have to agree with you that it certainly is an excellent package. If you want to get into C++ for Windows, it is about the best jumping-off point that I've come across. All you have to do is to build your user interface using the standard windows components available on the toolbars, and just add the code you need into the functions that it creates for you.

For sheer ease-of-use, though, I still think that Delphi wins out. With C++ Builder, you have to deal with C++ in an event-based environment and the fact that the whole point of C++ seems to be putting off writing any actual code for as long as humanly possible. This isn't Borland's fault, though, just the way C++ was designed, and if you can get your head round it all, it will do you a lot of good. ♦

al physical location on the drive.

If you look at the stats that the BIOS reported for your drive, you'll see that it suggests 789 cylinders x 255 heads x 63 sectors x 512 bytes per sector, which comes to 6,489,745,920 bytes or 6.4GB, which is exactly right.

Why does your BIOS report this as being only 147MB in the startup screen? Simple! There is a real, honest-to-goodness bug in the BIOS. As far as I know, this doesn't cause any real problems in use, but there is a rumour going around that a drive formatted with the buggy BIOS might not work correctly if you get a new motherboard. I haven't found any proof either way on this, but I wouldn't personally trust it with irreplaceable data...

You might want to look on the web to see if a flash BIOS upgrade is available. Check out Award's BIOS upgrade page at <http://www.award.com/tech/upgrade.htm>, but be aware that Award licences the basic shell of their BIOS to the motherboard manufacturers, who then customise it for their board. The actual upgrades, therefore, are supplied by the motherboard manufacturers and not by Award themselves.

The other option, of course, is to get a newer motherboard. And quite frankly, if your 850MB drive was current when you got your existing motherboard, then a new board would probably give your system a decent performance boost. Reinstalling your system to run off your 6.4GB drive will give quite a surprising speed boost as well, and you could keep important backups on the 850MB.

Serviceman



“Poppie, the video is broke — could you fix it, pleeease?”

FROM TIME to time, I get contributions that don't quite seem to fit into any category that suits this column. They're either not long enough, or too long, too complex and technical, or else so simple that nobody but the author would really be interested.

Then there are stories that are interesting enough for non-technical readers, and my only problem is to make them catch the attention of experienced people. The following group of small tales is a case in point.

Retirement 'fun'

THOSE OF US who are ostensibly retired know that you can never stop work. Even if you can persuade old customers to leave you alone with your slippers and pipe, the family will make sure that you are fully occupied during your retirement. (Only last week our postman delivered his TV with the mail. It was only a dry joint, but it took time to find and fix, when I should have been working at my retirement!)

To begin this month we have a series of small yarns from Reg Leahy. You might remember Reg as the contributor a year or two back, who wrote about the restoration of the drive-in cinema at Shepparton in Victoria. This time he is writing on a much more down-to-earth level. His subject is the small, unimportant jobs that we all collect, or have dumped on us, once we join the ranks of the 'retired'.

So here's Mr Leahy's human interest yarn...

I retired from full-time work over six years ago, and now I have time on my hands, my family bring to me all their broken FREDs (Flaming Ridiculous Electronic Devices) for me to try to fix.

The first FRED was a slimline telephone on which you could not hear the other person. (I reckon there'd be a market for this type of phone!) After what seemed an eternity trying to find the concealed screws, I finally prised it apart. The fault was staring at me. The phone had been dropped, and the printed board was cracked around the earpiece. A few pieces of computer cable across the break in the circuit board restored the phone to

Some of our servicing stories this month come from a technician with a familiar problem: he's supposedly retired, but seems to be working harder than ever before, thanks to jobs passed to him from family and friends (like grand-daughters who need their VCR fixed). We also revisit the tale of an old Playmaster amplifier that kept on emitting intermittent nasty noises — which took a lot of time and effort to track down...

full working condition.

The next FRED came as a phone call, from my four year old grand-daughter: “Poppie, the video is broke — could you fix it pleeease?” How could you refuse a request like that?

It was an Orion VCR which would not play tapes. Whenever I have been visiting their place, I always noticed the tape sensor light shining through the cassette loading door. This time I couldn't see the light, so I removed the top of the VCR and checked the continuity of the lamp. It was open circuit.

I ordered a new lamp and since it cost me \$12, I carried it home very carefully indeed. The lamp was installed into the VCR, and I then checked the unit's operation. It was all OK, so I returned the machine to a happy grand-daughter so she could watch her ‘Wiggles’ tapes.

Five weeks later, another call came saying that the VCR was not working again and the sensor light could not be seen through the loading door. This problem was a lot easier to find than to fix. It seems that my 11 month old grandson has developed ‘Inspector Gadget’ arms, and can now reach the on/off button on the front of the VCR. I left that problem with his mother to sort out...

My other daughter bought a second-hand

computer and asked me to check it over. I connected the units together and switched on. Up came the Windows for Workgroups logo and the first thing that I noticed was that the mouse was ratty (pun intended).

I disassembled the mouse and proceeded to clean its innards with some head cleaning fluid. That fixed the mouse. The computer had only the operating systems installed, so when my daughter and her husband came to pick it up, I took them through the installation procedure on how to load the programs they wanted to use. After tea, they packed up their computer and went home.

The next night I received a phone call saying the computer screen was very bright, the colours were wrong and one of the games programs did not work. When I had some free time I went over to check out the problem, and sure enough the colours were wrong. There was no green, just red and blue.

The first thing that I checked was the monitor plug at the back of the computer. It was tight, so I disconnected the plug and checked the pins. Sure enough, one was bent. This had occurred when they assembled the computer at home. The pin was straightened out, the monitor lead was re-connected and we had a normally coloured screen...

Then it was time to sort out the program that would not work. When I had set up the computer for my daughter and son-in-law, I'd installed a menu system to save them the problem of having to remember all the DOS commands. All they have to do is cursor down to the name of the program they want, hit enter and they're there.

The problem was, my typing skills were lacking on the day that I installed the program. I had mis-spelt the name of the program in the path description. I had an ‘E’ instead of an ‘A’. Once this was corrected, everything worked well.

Costly replacement

MY NEXT FRED was a battery charger for a Ryobi cordless drill. A quick check with the continuity scale of the multimeter showed that the primary winding of the transformer was open circuit. So off I went to the local

service agent to buy a new transformer. Or that was my intention — until I was told the price of a replacement part was nearly a third of the cost of a complete new drill set...

I dived into the junk box and found a transformer that I had once bought on spec, hoping that one day it could be useful. This was its day! But it was slightly larger than the original transformer and it took a little bit of micro surgery on the case. It soon fitted and worked like a charm.

Then I was given an old HMV 63cm colour television set that had no sound. The owner was quoted more than he thought the set was worth to fix it, so that was how it ended up in my hands.

A quick trace of the audio on the sound module came to a dead end at the input of the audio IC. From the other side of the IC a signal was injected and sound was heard from the speaker. I unplugged the module and asked my friendly service technician if he could supply a replacement IC.

Instead, he sold me a complete module from a junked set, for just \$25. I plugged the module in, switched the set on and was pleased to hear normal sound. The original owner was a bit upset to learn how little it cost me to repair the set, compared to what he had been quoted.

I managed to acquire another identical set, to keep for spare parts as I had given the original set to my daughter. A year later I received a phone call saying the picture on the set would fade out then come back. Could I have a look at the set sometime?

I wasn't too worried, because I had a spare set to cannibalise for any parts that may have been required. I went around a few days later and sure enough, the picture faded just as described. From my old days of working with valve equipment, I checked to see if the filaments of the picture tube were alight. Sure enough, they weren't!

A touch on the board brought the heaters back to life. So out came the soldering iron and I re-soldered the dry joint on the tube base board. There was no more problem with fading pictures.

They eventually replaced the old HMV with a new set and gave me back the old one. So I advertised in the local paper a '63cm colour television set — free!' That was the worst mistake that I have ever made. The phone started ringing at 6.30 in the morning and rang virtually non stop until lunch time the next day. One caller wanted even to know "How much are you selling the free TV's for?"...

Top priority job!

THEN THE DISHWASHER at home started to play up. It would go through the wash cycle in a much shorter time than it should normally take. And the dishes were not being cleaned.

This was a top priority job, as I have no desire to wash the dishes by hand! So after reading the workshop manual, I worked out that a 'Clixon' thermostat attached to the

underneath of the inner container was faulty.

This thermostat should switch off the timer motor when the rinse cycle finished, then the wash cycle could start by filling the inner bowl with water. This level is set by another timer which has two settings, depending on whether your water supply is tank or town.

The circulating pump, spray arms and water heating element continue running during this period. The heating element brings the water up to temperature, while the circulating pump sends the water through the spray arms onto the dishes.

When the water reaches the required temperature, the thermostat switches the power back to the timer motor, allowing the rest of the cycle to continue.

In this case, the thermostat did not switch off the timer motor, allowing the machine to go through its cycles without heating the water. Replacing the thermostat soon had the dishwasher back to normal operation.

Monitor resurrected

FOR THE LAST few months, I have been after a Commodore Computer monitor to use as a monitor in conjunction with my PC, to help with my Video Editing suite that I have running at home.

One day I went to a garage sale around the

corner and there was the monitor that I was after. At the conclusion of the wheeling and dealing, I was the proud owner of a Commodore monitor.

The original owners said that it was not working properly since it had been dropped. Sure enough, it did give a terrible picture,



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Serviceman

but the problem was simply that the fall had distorted the outer case, thereby preventing the RCA plug from mating properly with its socket. Re-adjustment of the cabinet soon fixed that and I now have a sharp clear monitor for the editing suite.

I'd better stop now. My brother-in-law has just arrived with a trailer he wants me to rewire! So there you are. Let that be a lesson to all you techs who are approaching retiring age. You'll soon be working harder than ever — or at least that's what it will seem like! Thanks for that contribution, Reg. As I said at the top, a lot of these jobs we get are simple ones that don't take a lot of brainpower to solve, yet they do help to cement the family ties. I reckon your grand-daughter now thinks you come from somewhere close to God.

By the way, readers might be saddened to learn from Reg's covering letter that the Shepparton Drive-in Cinema he wrote about before is now no more — it's on its way to becoming a new shopping centre. As Reg comments, such is progress!

Thanks again, Reg, and I hope that's not the last we'll hear from you.

Troublesome amp

ABOUT A YEAR ago, in the November 97 column, New Zealand contributor Bert Toomey told the story of his search for the cause of intermittent distortion in a Playmaster amplifier. He eventually traced the problem to a touchy trimpot and replacing this seemed to cure the trouble. However, it was not to be, and Bert is now back with further notes on the problem.

Here's what he has to say...

More on the continuing saga of the noisy Playmaster amplifier which had been left for further investigation during the Christmas vacation. (In the meantime, I built the Economy 15 watt amplifier from a DSE kitset. The performance is great and I would recommend it to anyone looking for a medium powered amplifier.)

When I returned to the Playmaster, it was clear that some oscillation was taking place. A transistor radio tuned to the bottom end of the broadcast band fairly roared with static when placed near the output transistors.

Serendipity was on my side, when I found one of the resistors across an output choke had come unsoldered. I had replaced these earlier when they had become very hot. But — there was still some noise present, though not as much as before.

The portable radio, upended for minimum pickup, was moved over the board and made fearsome noises over the 1000uF cap associated with the BZX70 C15 zener. I gave the cap a tug and the noise ceased.

Another dry joint to be fixed — sometime.

At last, all seemed well and I sat back enjoy a little Mozart. For about 10 minutes.

There it was again, that mysterious scratchy noise which had started me off in the first place. It was like an AM radio aerial rubbing against something metallic.

A squirt of freezer spray on the 4.7k resistor supplying the four indicator LEDs cured the problem. I have since replaced all the high wattage resistors, and the amp now seems to be going as well as ever. To say the least, this was a long and frustrating repair.

I don't know if this kitset had been made up from a batch of doubtful components, but I certainly seem to have got more than my share of dodgy bits with this one.

While I'm with you, I'd like to relate a

tion of resonance. I took out the oscillator transistor, as I've found this can be a cause of 'no dip'. Again, no luck. I checked the dip meter against a separate coil and capacitor and there was no problem.

I rechecked the board but could find no mistakes. While looking at the underside, the penny dropped.

The continuous earth track was acting as a shorted turn. A quick saw cut through that track proved the theory to be correct. I was able to dip all the coils and then soldered a piece of wire over the cut to repair the track.

A recollection of this incident came out of the memory bank recently when I wanted to modify the circuit board of a SSB transceiver I have been building (see diagram). At switch on, one crystal oscillated but the other wouldn't.

I later discovered I'd made a small mistake in modifying the board, but when this was rectified, neither crystal would oscillate. Or so it seemed.

I went through the usual checks and found there was a sniff of RF at the FET drain, but nothing like what I was expecting.

Frustration was beginning to set in and with an indoors temperature of 28°C, I decided it was time for a cool one and to leave things for a while. I was certain it was some fault I had created, and a memory of the signal generator began to surface.

Looking at the underside of the board showed that the gate of the FET was now earthed securely, but about 290mm from where the earth clip was connected. A short piece of wire from the FET gate to a point close to the earth clip cured the problem. Clearly, it pays to keep your earth leads short!

It certainly does, Bert. It certainly does. In fact, I recall something akin to that from an early colour TV.

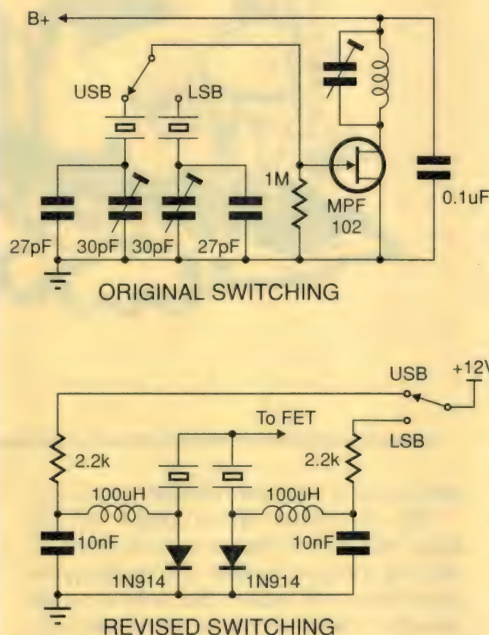
The earth return from the aquadag to the chassis and CRT baseboard was attached with small spade clips at each point. The lead, about 18 inches long, had a clip at each end and one in the middle.

The correct installation was the centre clip to the aquadag and the end clips to the baseboard and chassis. However, someone had changed this to put the centre clip on the baseboard and the ends on the aquadag and chassis. The effect was to double the length of earth lead from the aquadag to the chassis.

The result was a hideous scratching noise in the speaker, and a massive display of small white dots on the screen. It took a long time to find that one!

Thanks for those stories, Bert. They were most interesting. And that will have to be all for this month. I've run right out of space and I don't want the editor chopping into our efforts!

See you all next time. ♦



couple of small matters that are not about servicing per se, but concern two related earthing problems discovered during the construction of other projects.

Some time ago, I built an RF signal generator. The earth track ran around the outside of the board with spurs which picked up various components. The generator was designed for five ranges and prior to switch on, I decided to dip the coils as a preliminary check that the ranges were as designed.

(For those unfamiliar with the term 'dip', it's a means of testing tuned circuits to see if they will resonate at the desired frequency. A small calibrated oscillator is brought close to the coil under test and tuned across the band. If the circuit is working properly, it will 'suck' energy from the oscillator and cause a meter to 'dip' at the resonant frequency. A faulty coil or off-frequency circuit will show no reaction on the dipmeter.)

None of the coils would give any indica-

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Circuit & Design Ideas

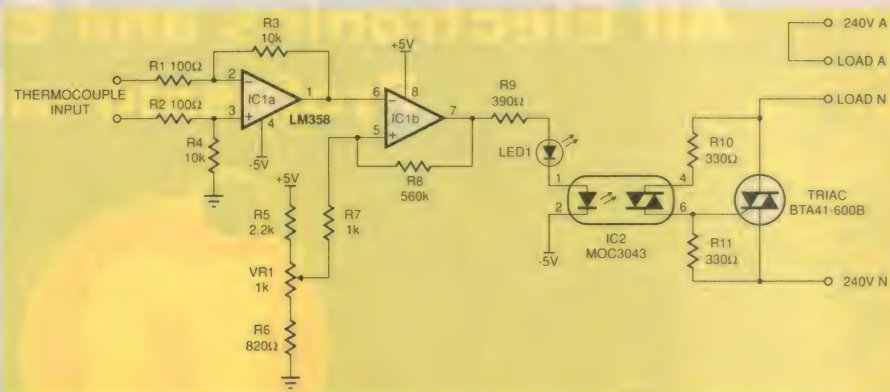
Interesting original circuit ideas and design tips from readers. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

Thermocouple thermostat

This circuit was designed after yet another failure of a capillary-style mechanical thermostat in our roller tinning machine. It consists of a differential input voltage amplifier with a gain of 100 followed by a comparator, all based on a single LM358 op-amp. The output of the comparator drives a series combination of a LED and zero-crossing optotriac which triggers a Triac to control the power to a heating element. (In our case, two 700W elements in parallel).

With the circuit values as shown, the range of temperature is approximately 200-400°C. The Triac used in our circuit was one we had to hand, but a different type should work without any modifications.

To change the temperature control range, the values of R5 and R6 can be adjusted to



suit a particular need. Input to the circuit was a length of 0.81mm K-type thermocouple wire, twisted together at one end and connected (with suitable polarity) to the circuit.

For readers that are interested, I can sup-

ply PCBs and thermocouple wire for this project; just write to the address below.

T.A Mowles
18 Deacon Ave.,
Richmond, SA, 5033. **\$35**

Curve Tracer Adapter for DSOA

Curve tracers are usually intended for a dual trace oscilloscope with X-Y function. Obviously the DSOA doesn't have that ability, and so this adapter allows the RAM to store horizontal and vertical data alternately through the 4051 analog MUX, used here as a SPDT switch. Simple, no frills software is used to display the trace on your PC.

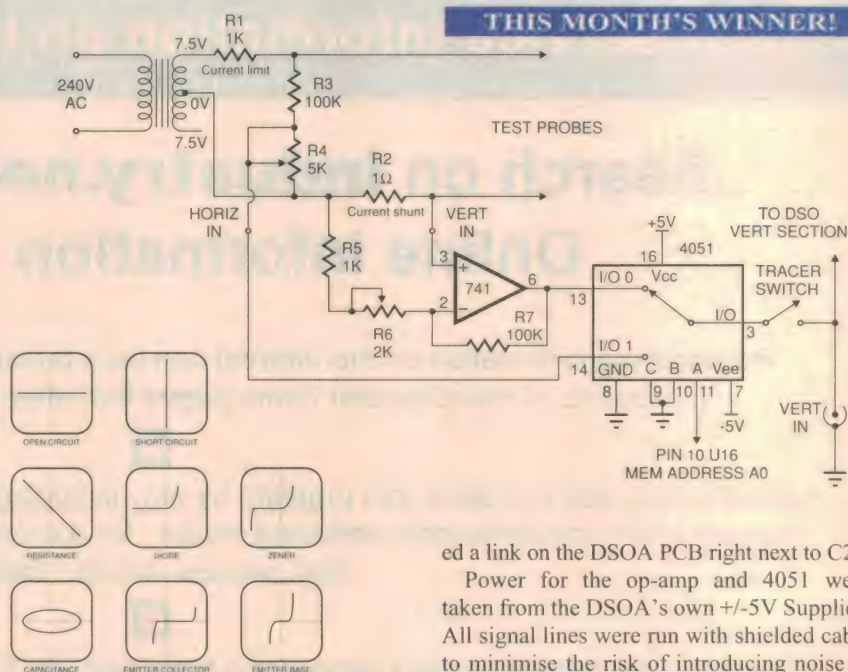
AC voltage is supplied from the mains transformer in the DSOA. R1 limits the current at the test leads while R2 provides a current shunt. The values measured with my DSOA were 8.8V AC at the test leads, 8.8mA short circuit current and 8.8mV across the shunt.

The voltage for the horizontal input is measured across the test leads, and reduced by R3/R4 to around 2V.

The vertical input voltage is measured across the shunt and would normally be fed to the 'B' channel of a CRO with the appropriate vertical sensitivity selected. The 2V range required to display the horizontal input on the DSOA does not provide much resolution for the 8.8mV vertical input, so an op-amp is used to bump things up a tad.

The op-amp is a garden variety 741. R5-7 were selected to provide an adjustable output of around 2V with an 8.8mV vertical input from the shunt R2.

The vertical input from the op-amp, and the horizontal input are connected to I/O0 and I/O1 of the 4051, with its output (pin 3) connected



via a switch to the vertical input of the DSOA.

The 4051's A input is connected to the first address pin (A0) on the DSOA RAM U16. As the RAM address is incremented during sampling, this pin is toggled allowing the analog switch to select which input (vertical or horizontal) is measured by the DSOA.

To connect the address line, the clever developers of the DSOA have conveniently provid-

ed a link on the DSOA PCB right next to C20.

Power for the op-amp and 4051 were taken from the DSOA's own +/-5V Supplies. All signal lines were run with shielded cable to minimise the risk of introducing noise to the DSOA.

Michael Nilon
Crib Point, Vic. **\$40**

The software for this project is available from the EA Website (www.electronicsaustralia.com.au) as the file CURVE.ZIP. If you don't have Web access, We can email you the file, or you can download it from our BBS ((02) 9353 0627). Failing this, you can order it from our Reader Service department for \$5 P+P.

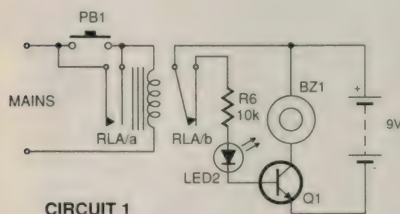
As an added incentive for readers to contribute interesting ideas to this column, the idea we judge most interesting each month now wins its contributor an exciting prize, in addition to the usual fee. The prize is an open order to the value of \$300 from Oatley Electronics! Yes, that's \$300 to spend on anything you want from Oatley's wide range of products, so check out their ad (or their Website) to see what's on offer.

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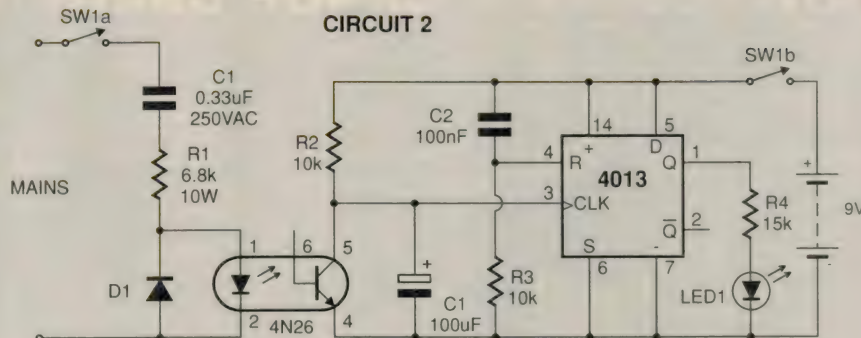
Loss of power indicator

Back in September 1997, in Peter Phillips' *Information Centre* column, there was a request for a loss of (mains) power indicator. I've only just come across the request, so here's my suggestion.

Circuit 1 is the old favourite 'No Volt Relay'. It requires a mains-rated relay coil with at least one set of mains-rated NO contacts, plus a momentary mains-rated push-button. If you wish to incorporate the rest of circuit 1, the relay will need to provide an additional set of NC contacts.



Operation is fairly obvious: with the device plugged into a live mains socket, press the button. This energises the relay and so when you release the button, the relay remains energised via its NO contacts. Only a mains failure will allow the relay to release and drop back to the un-energised state. Note that the second pair of contacts will be held



open until the relay drops out, at which time the secondary circuit will be energised.

A disadvantage of this circuit is that the battery will be draining unless the device is both plugged into a live mains socket and the button pressed. On the other hand it is cheap — especially if, like me, you have such relays lying around, desperate for gainful employment.

If your junkbox doesn't stretch to a mains-rated relay, or you'd rather a low power isolated circuit, consider circuit 2.

The 4N26 needs around 20mA to drive its internal LED, which meant a series impedance of around 12.5k. At 50Hz, C1 provides an Xc of 9.6k, and so the R required is 7.9k with a power rating of 3.2 watts.

The low voltage side of the circuit is pretty straightforward. The 4013 is a CMOS D

type flip-flop wired up as a latching single-shot. At power-up, the circuit is reset briefly via C2/R3, forcing Q to a low state.

Providing that the 4N26 is 'illuminated' the clock pin should be low: True, every negative half-cycle of the mains, 4N26 is not illuminated and in fact, probably not sufficiently illuminated for the first and last milliseconds of the positive half-cycle, which is where C1 comes in to play. In order to keep clock pin below its high threshold during the unsaturated condition of the 4N26, the voltage on C1 must take longer than 15ms to reach 4.5 volts. This comes out to just over 2uF, with R1 at 10k.

The final value of C1 depends on how sensitive you want the circuit to be.

Brian Critchley
Elanora Heights, NSW \$30

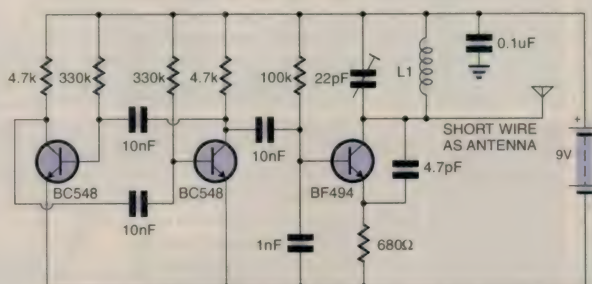
Wireless TV test pattern

This circuit would be very useful to TV technicians, or anyone else testing TV sets in the VHF bands in the absence of programme signal from a TV station. If this circuit is placed near a TV set tuned to the VHF band, the screen will display bright horizontal lines and an audio tone will be heard from the speaker.

The first two transistors form an audio frequency mono-stable multivibrator, with its output modulating the VHF oscillator based around the third (HF) transistor. The oscillator coil is four turns of 20SWG, space wound to 15mm on a 3mm core.

There is no need for a direct connection to the aerial of the TV set, as a short length of wire (say 30cm) is enough to transmit signals up to around 50 metres. A standard 9V battery is quite suitable, as the circuit draws only 10mA.

Pradeep G.
Alappuzha, South India. \$30 ♦



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Suitable for a number of jobs. The bracket allows you to mount on a wall or fence, or hang it in a tree. The spike allows you to put it in the ground. Accepts MR16 halogen globes (not supplied). Size 100(H) x 96 Dia. mm. excluding bracket and spike.



Cat. SL-2774 **\$29.95**

WALL MOUNT STEP LIGHT

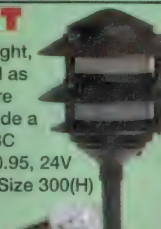
This light will mount on a wall, and is ideal for lighting a path, or steps. All light points down, so there is no glare. Size 100(dia.) x 50(D) mm. Accepts halogen JC pin globes (not supplied). Globes 12V 20W Cat. SL-2722 \$2.95 24V 35W Cat. SL-2723 \$4.95



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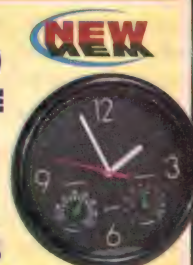
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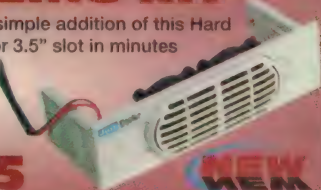


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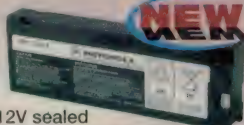


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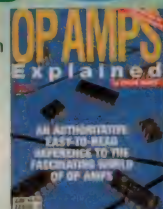
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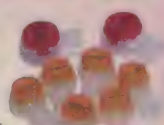
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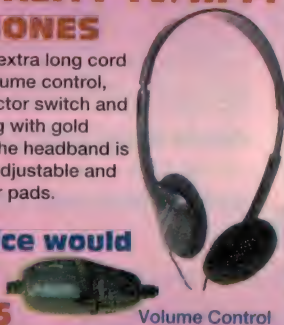


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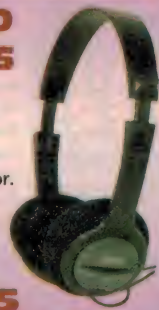


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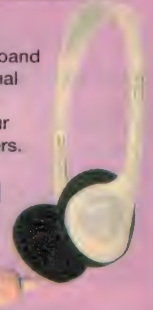


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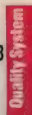


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Putting a CPLD to Work - 1

Fancy trying your hand at using a CPLD (Complex Programmable Logic Device)? Up until now these devices were well out of the realms of the average hobbyist, but now that Dick Smith Electronics is selling a CPLD Starter Kit for under \$100, they look to be quite a practical proposition for any of your larger logic designs. In this article we'll take a look at CPLDs, and outline a sample CPLD project that we'll present in full next month.

by Graham Cattley



WHEN YOU'RE designing digital circuits (or at least circuits with a large number of gates, flip-flops and the like), there comes a time when you think that there must be a better way... When you're lost in a tangle of gates and control lines, you are tempted to think that one of these 'better ways' might be to use a microcontroller or PIC; but these devices do have a couple of major drawbacks.

First, you need to be reasonably well versed in the micro's programming language and physical capabilities; second, there's the problem of actually getting the program onto the IC. The need to spend weeks learning about and coding the micro, and then having to go out and build a programmer to implement it, means that usually you just stick to doing it the hard way with discrete AND gates and flip-flops...

There is *another* way, however; although up until now it's been quite out of reach of the average hobbyist. The CPLD (Complex Programmable Logic Device) is an array of AND and OR gates that are interconnected by a EEPROM 'mask'. With the correct programming, a CPLD can replace hundreds of discrete logic gates in one single

The Vantis CPLD programming kit contains a programming board (With 44-pin PLCC ZIF socket), a buffered parallel cable and of course the Vantis Synario starter software.

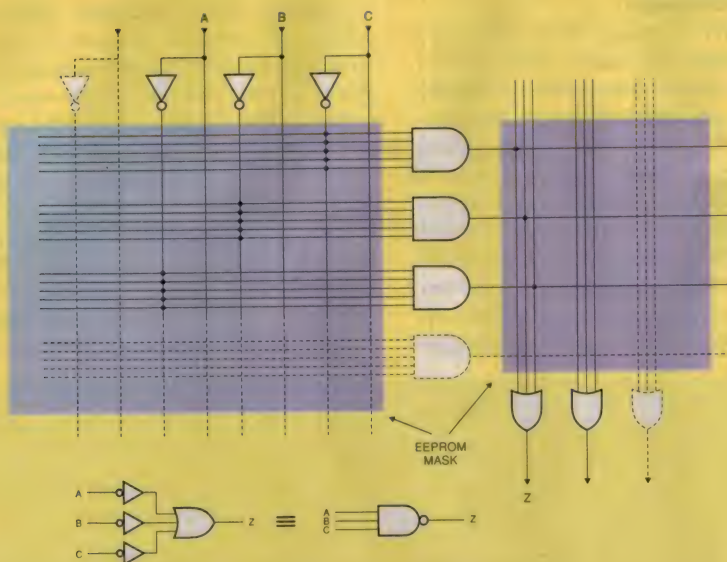
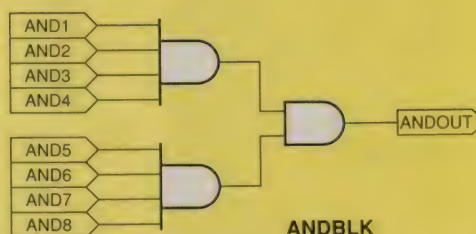


Fig.1: This is a representative view of the internal configuration of a PLD. An EEPROM mask allows you to program the interconnections to produce any logic function required — a three-input NAND gate in the example shown here.

Fig.2: This is an eight-input AND gate that we assembled and saved as a block called ANDBLK. The schematic editor in the Vantis Synario software lets you create new component blocks in this way, which makes for a much simplified block schematic.



chip. All very well, I hear you say — but don't we still have all the problems associated with using a microcontroller, as well as the problem of actually purchasing a CPLD? Well, no.

Dick Smith Electronics are now selling Vantis' MACH Starter Kit, which contains two CPLDs as well as programming software and an interface board. The two CPLDs supplied are the M4 32/32 and the M4 32/64, which offer 32 I/O pins, and 32 or 64 macrocells respectively. These plug into a 44-pin PLCC ZIF socket mounted on the interface board, which is then connected to your PC's parallel port via a two-metre buffered cable. The supplied Vantis Synario 'starter software' then lets you configure the CPLD chip for your job.

By the way the software is listed as running under Win95 and NT, but after a little digging around on the supplied CD ROM, I found a Win3.11 version that seemed to work perfectly well.

If you are worried about having to learn a new programming language, then relax. With Vantis Synario you can simply enter the circuit schematic and let it do the rest. Whole circuit blocks are available in libraries, which means that things like flip-flops and counters can be simply dropped into the circuit, letting you concentrate on

the higher levels of the design. Problems such as timing delays, chip count — and, of course, having the gate you want over on the other side of the board — are gone forever.

Table 1

| Switch Position | IN1 | IN2 | IN3 | Output |
|-----------------|-----|-----|-----|--------|
| 1' | 1 | 0 | 0 | 0 |
| | 1 | 0 | 1 | 1 |
| X' | 0 | 0 | 0 | 1 |
| | 0 | 0 | 1 | 1 |
| 0' | 0 | 1 | 1 | 0 |
| | 0 | 1 | 0 | 1 |

Inside the CPLD

OK, SO YOU'RE sold on the idea of using a CPLD in your design; but what's *actually* going on inside the chip? Fig. 1 is a somewhat simplified view of the layout, but it highlights the fact that all logic circuits can be efficiently reduced to a network of AND and OR gates, as long as normal and inverted input signals are available. This gets back to the old 'Product of Sums' system of logic simplification.

By linking the various rows and columns in both the input AND and the output OR matrixes, you should in theory be able to create any logic function you want. To demon-

strate this point, I've shown the links required to produce a functional three-input NAND gate; follow it through and you'll see that it isn't as complicated as it looks...

In early PLAs (Programmable Logic Arrays), the programming links were arranged by literally burning out the unwanted connections, which left the required connection pattern. These days things are a little more civilized, and the link pattern is held in an EEPROM, which attracts the huge benefit of the ability to re-program the device as required (how many of *your* large logic designs work first time?).

So by programming the EEPROM with a connection pattern, it's easy to see how various logic gates can be created (as in the NAND gate shown), and how a more complex logic block could be produced.

This, of course is a very simplistic view of a modern CPLD, which expands on the process enormously. Vantis' MACH4 32/32 series of CPLDs offer four blocks of eight 'macrocells', with each of these cells being able to support 20 logic blocks. This theoretically equates to around 640 simple gates, which can be arranged in just about any order to produce your design. Practically speaking, however, other factors come into play — such as the ratio of synchronous vs asynchronous logic blocks,

and the overall complexity of your design. This does cut down the number of gates you can actually use in your final design.

The M4 32/64 offers double the number of macrocells (giving you around 1280 gates), but this brings to light the other limiting factor with CPLDs: the number of I/O pins. Both the M4 32/32 and the M4 32/64 come in 42-pin packages, which gives a maximum of 32 pins for I/O. Any of these I/O pins can be assigned to any of the inputs or outputs of your logic design, however, which makes PCB layout much, much easier.

Trigger Adapter

WELL, THAT'S enough theory; now let's look at a design that makes good use of a CPLD. One project that seemed to have the potential to take good advantage of everything the CPLD had to offer was our Digital Trigger Adapter, which we presented back in the April 1995 issue of *EA*. It provided eight switch configurable inputs, and would generate a trigger pulse when the logic levels on the inputs matched the switch settings. A number of expansion units could be added to take the number of inputs up to 24, making it suitable

for memory address decoding. The trigger output was primarily designed to drive a scope, and an adjustable delay was also available to let you 'walk through' the waveform.

The original circuit employed the services of 21 assorted AND, OR and EXOR gates, along with two monostables — all spread over seven separate ICs. Added to these were 40 resistors, five capacitors and nine diodes. By using a CPLD, this circuit could be boiled down to one IC, with a single resistor and capacitor as the only external components.

That's right, everything on one chip, which

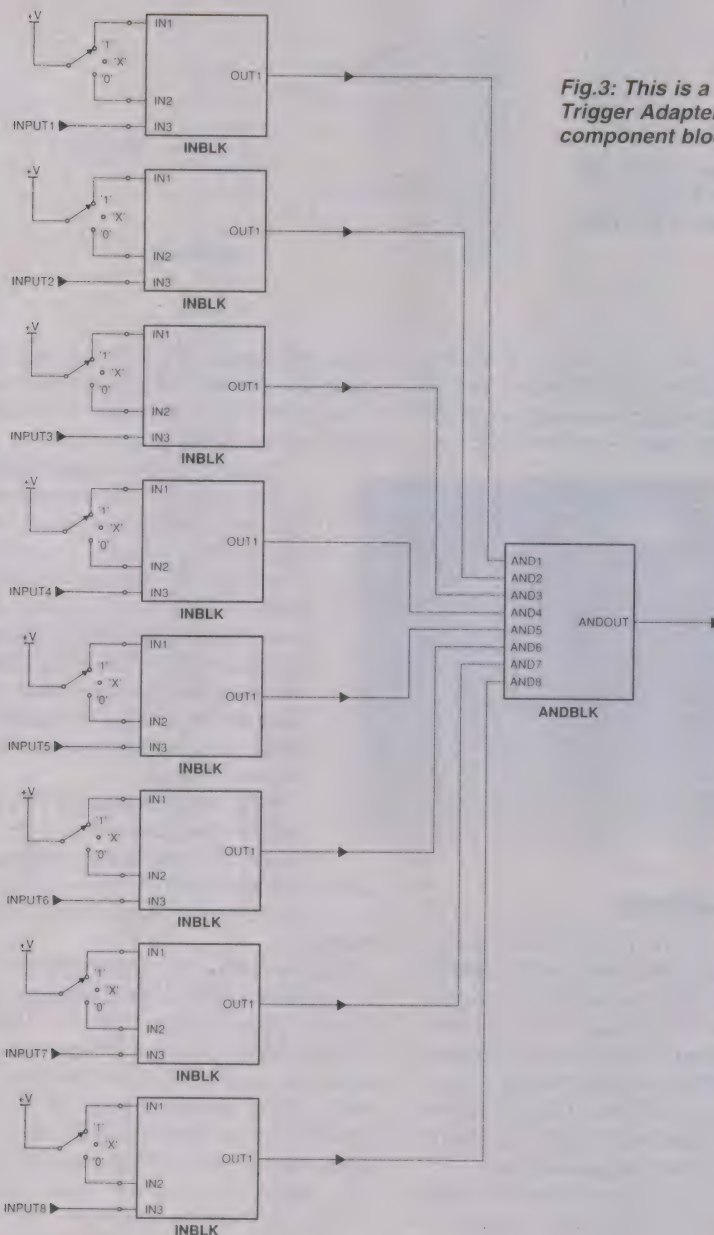


Fig.3: This is a schematic diagram of the first half of the revamped Trigger Adapter project, using our newly created INBLK and ANDBLK component blocks. Compare this with the original circuit in Fig.4.

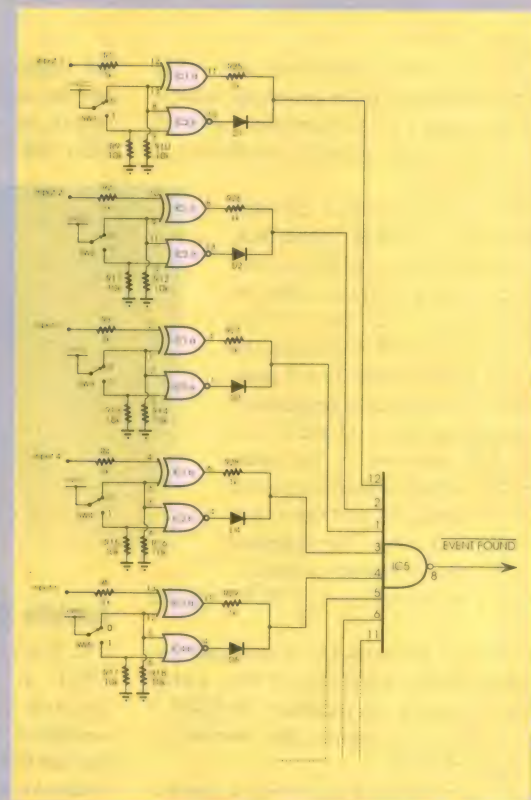


Fig.4: This is the original Schematic for the first half of the Trigger Adapter, published in the April 95 issue of *EA*. All of this, plus more will be incorporated into a single CPLD.

shows the sort of space (and cost) savings you can get with these devices. But there are a couple of reasons why we haven't gone for such a radical solution in our final design.

The first and foremost is that the 32/64 device supplied in the MACH starter kit isn't quite big enough to accommodate the whole circuit — and while we certainly could have used one 32/64 and one 32/32, this wouldn't have left any ICs over for expanding the unit. As a result, we settled on a design that used one M4 32/32 for the bulk of the logic, and an external 74HC123 monostable to provide the variable trigger delay.

This leaves one M4 32/64 from the kit left over, which can then be used to build a slave unit (if desired), to bring the total number of inputs up to 16.

The 'circuit'

Fig.2 shows the starting point for this design, which was to create a functional eight-input AND gate. As we didn't have the exact gate we wanted in the library we were using, we elected to create a mini schematic block which contained two four-input AND gates, and a two-input AND as shown. This block can be seen in Fig.3 as 'ANDBLK', being fed by eight input blocks called (imaginatively enough) INBLK.

The internal design of these INBLK circuit blocks was looking to be rather complicated, so we decided to forgo the schematic approach and use a data table to define them instead. The flexibility of the software used to program these devices lets you take this sort of shortcut, and so by simply defining INBLK as having three inputs, one output and the appropriate truth table, we can save ourselves an awful lot of work. Table 1 shows the truth table we used, with the output high only when the input logic level matches the position of SW1.

Once these two blocks were defined, we could 'wire them up' in the schematic editor to produce the first half of our circuit, as shown in Fig.3.

That's about all we have room for in this issue, so we'll cover the second half of the design — along with the construction of the revamped trigger adaptor — in next month's issue.

Until then, if you want to have a go at driving the software or even programming a device yourself, I suggest that you go out and pick up a Vantis Starter Kit from Dick Smith Electronics. At the price of \$99 these kits are certainly worthwhile, and playing around with one will get you up to speed for the construction project detailed next month. ♦

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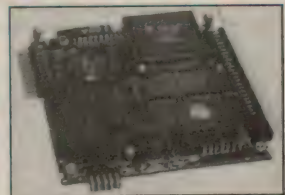


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\$10 Wonders

17 — Mini Roulette

The Festive Season is nearly upon us, but there is just time to get busy with the soldering iron and produce something to enliven the Christmas and New Year parties. This Mini Roulette game has all (well, nearly all!) of the features of the full-sized casino game, plus a few of its own...

ROULETTE DEPENDS on the fact that the 'canoe' in which the ball finally settles is decided purely at random. Players place their bets (and casino operators calculate the odds) on this assumption. Obtaining randomness in an electronic logic circuit is rather difficult, for everything is so predictable. One could base the operation on the truly random white noise generated in a reverse-biased diode, but the circuit would be tricky to build and would fall outside our \$10 price bracket.

Instead, we obtain a *kind* of randomness by relying on the inexact behaviour of the human operator (especially when the party is in full swing!).

Arranged in a circle, 10 LEDs on a baseboard represent the roulette wheel. When you press the GO!! button the LEDs light up in turn and so a spot of light (the ball) travels around the circle for as long as you hold down the button. When you release the button, the ball continues circling for a few seconds longer, then stops at one of the numbered LED canoes.

In electronic games of the 'heads or tails' variety, the circuit usually runs so fast that you can not see which LED is lit at any instant, and it is impossible to cheat by releasing the button at the right moment. In this game we like seeing the ball rolling round the wheel, but this relatively slow action makes it possible for the unscrupulous 'croupier' to cheat after a little practise. The outcomes may then be far from random!

There are two ways out of this. One is to speed up the action of the oscillator that drives the ball, so that the ball whizzes round almost invisibly. The other is to insist on the operator looking away from the wheel before releasing the button. Of course, making a bug into a feature, you could turn it into a game of skill in which players score for making the ball stop in a pre-decided canoe, or on either side of it. Make up your



Here's the Mini Roulette with a coloured paper label to give it a more realistic touch. The large HI/LO led indicates numbers above or below five, while the odds on the Jackpot LED coming on are 20 to 1.

own rules for playing that way...

As well as the wheel of 10 LEDs, there are two other features. The HI/LO LED is a jumbo-sized LED that comes on and off once for each revolution. At the end there is a 50% chance of its being on (HI) or off (LO). Players can bet on which it is going to be. Finally there is the Jackpot LED. We used a green flashing LED for this. On alternate revolutions, this comes on if the ball stops at 0 (the odds on this are 1 in 20). This is not a feature of roulette, but adds to the fun of the party.

How it works

THE CIRCUIT (Fig.1) uses three CMOS logic ICs: a 4011 quad 2-input NAND gate, a 4013 dual D-type flip-flop, and a 4017 decade counter. The 4017 provides the 'mechanism' for the wheel, and it counts clock pulses from IC2b, which together with IC2c forms an oscillator running at about 10Hz. The counter has 10 outputs numbered 0 to 9 and one of these goes high at each count. It begins with output 0 and runs in numerical order to 9, repeating indefinitely.

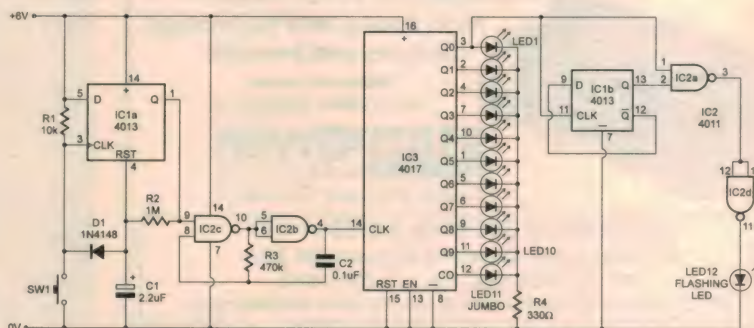
The LEDs on the wheel are not (except for 0) numbered in the same way as the outputs, but in an apparently irregular way, as on a roulette wheel. They are wired so that the spot of light travels round the board once for every 10 counts.

IC3 has a 'divide by 10' output (called a 'Carry Out') which is high for counts 0 to 4, and low for counts 5 to 9. This drives the jumbo HI/LO LED, which is comes on and goes off once every 10 counts.

Control of the Jackpot LED is a little more complicated. It is driven by the 0 output, the signal being passed to a NAND gate (IC2a) along two routes, direct and by way of a D-type flip-flop (IC1b). The flip-flop is wired as a 'divide by 2' circuit, and its output changes state each alternate time the 0 output goes from low to high.

Each time around the wheel, the 0 LED flashes and the output of the flip-flop (IC1, pin 13) changes state. On the first time round both inputs to gate IC1a are high so its output (pin 3) is low. This is inverted by IC1d, which goes high, flashing the jackpot LED (LED12) for an instant. On the next

Fig.1: The flip-flop IC1a is configured as a monostable which runs allows the oscillator (IC2b and c) to run a short time after you release the button. The 4017 then cycles through the LEDs, with flip-flop IC1b enabling LED12 on every other time 'round the block'.



time round, output 0 goes high again but this makes the flip-flop output go low, so the LED does not flash. This cycle repeats, until the 'ball' happens to stop on the 0 LED while the flip-flop is high. In this case, the jackpot LED goes on and stays on, flashing automatically with its built-in oscillator. Time for a big win!

The other half of IC1 controls the run time. This is connected as a monostable, which (unlike many monostables) is re-triggerable. Its output (pin 1) goes high when SW1 is pressed. This allows the clock circuit (IC2b/IC2c) to run and the ball circulates. This high output gradually charges C1 through R2, and the voltage across C1 rises slowly until it has reached a level which causes the flip-flop to be reset. The output now goes to 0V, stopping the clock.

If, however, we press and hold SW1, or if we press it again while the voltage is still rising, C1 never charges enough to reset the flip-flop. The output remains high and the clock runs for a fixed period after the last time the button is released.

Construction

THE PROTOTYPE was enclosed in a plastic screw cap about 85mm diameter. You could cut a panel from cardboard or plastic sheet instead, or build it on the lid of a jiffy box. The design for the wheel was printed in black and white, so we painted it with watercolours and then glued it to the top of the cap.

The stripboard layout (Fig.2) is very compact so that it can be concealed beneath the cap. Note that strips are NOT cut at D15 and F15 beneath IC2.

Fortunately we are able to drive the LEDs directly from IC3 without need for driver transistors. A single resistor (R4) serves to limit LED current, and note that the flashing LED doesn't need a series resistor. The diode is mounted with its anode at E21 and its cathode (k) at D21. If you want to make the clock run faster (to make cheating more difficult), substitute a 47nF or 22nF capacitor for C2.

To test the circuit, apply power and wait for a few seconds, and then use a voltmeter (preferably a moving-coil one) or logic tester to check IC1 (pin 3 high, pin 1 low), IC2 (pin 10 high, pin 4 low), and IC3 (one of the outputs high, the rest low).

Press and hold SW1. Check IC1 (pin 3 low, pin 1 high, pin 13 alternating high and low every two seconds), IC2 (pin 4 alternating high and low at about 10Hz, pin 11 going briefly high once every two seconds), and IC3 (output pins briefly high about once a second, except pin 12 which changes state every half second). The circuit reverts to the original state about two seconds after button is released. If all these checks are confirmed, the circuit is working correctly. If not, the symptoms should tell you in which section to look.

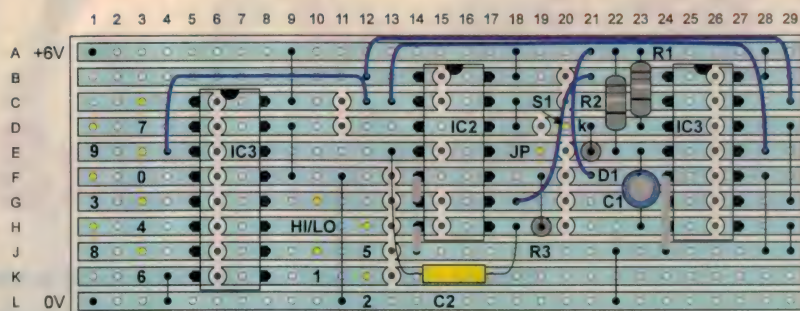


Fig.2: Above is the stripboard overlay, with the LED and switch connections shown in yellow. Don't miss the JP pin to the right of IC2, or S1 hidden away at D 20. Below is the internal wiring for the wheel, with each of the numbered LED anodes connected to their respective pin on on the board.

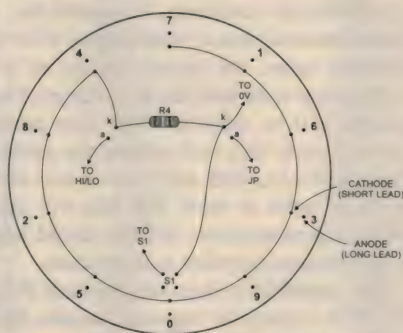


Fig.3

Using a 1mm bit, make holes through the paper pattern and baseboard for the leads of the LEDs and the terminal pins of the switch. The pattern is shown in Fig.3, viewed from below. The LED leads are 1.25mm apart and those of the switch are on the corners of a 5mm square. Insert the LEDs from above with their anode wires (the longer of the two) toward the outside, and the 'flats' on their rims toward the centre. Insert the switch with the 'flat' to the outside. A spot of glue on the bottom surface of each LED helps them to stay in place. Allow to dry before proceeding.

Cut and strip a 25cm length of single-core wire, and working around the circle clockwise from LED7, join the cathode wires of the LEDs. Quickly solder the joint and check that the LED still has its bottom surface flat on the baseboard.

From LED4 (the last one), carry the bare wire across to the HI/LO jumbo LED. Cut off the wire at this point and solder R4 between it and the cathode of the jackpot LED. Also connect the cathode to SW1, and then test that the connections are good and that the LEDs have not been damaged while soldering. To do this, connect the 0V wire to a 6V battery and connect each anode wire in turn to the positive terminal.

Now use some ribbon cable to connect

the LEDs to the circuit board. Place the circuit board close to the inverted baseboard, and solder each wire to its pin on the board. Finally, turn the circuit board over and mount it behind the baseboard while making sure that no part of it shorts out the exposed LED and switch connections.

To play, you'll need a supply of chips (betting, not silicon), and a layout mat where players may place their bets. This can be a rectangle of thin card marked out with areas numbered 0 to 9, HI and LO, and any other betting possibilities such as EVEN and ODD, or THREES (3, 6, or 9).

Have fun! ♦

Parts List

Resistors

| | |
|----------------|----------|
| (all 5%, 1/4W) | |
| R1 | 10k |
| R2 | 1M |
| R3 | 470k |
| R4 | 330 ohms |

Capacitors

| | |
|----|-------------------------|
| C1 | 2.2uF 16VW electrolytic |
| C2 | 0.1uF polyester or MKT |

Semiconductors

| | |
|---------|----------------------------------|
| D1 | 1N4148 signal diode |
| IC1 | 4011 CMOS quad 2-input NAND gate |
| IC2 | 4013 CMOS dual-D flip-flop |
| IC3 | 4017 CMOS decade counter |
| LED1-10 | 5mm red (or assorted colours) |
| LED11 | 10mm red, Jumbo |
| LED12 | 5mm green, flashing |

Miscellaneous

| | |
|------------|---|
| SW1 | NC pushbutton switch |
| Stripboard | 30 x 75mm (11 strips x 29 holes), 15 x 1mm terminal pins, 2 x 14-pin IC sockets, 16-pin IC socket, battery holder (four x AA cells), materials for making baseboard and betting layout. |

A PC-Based DSO Adapter Mk3 - 2

Here's the second article describing a new and enhanced digital sampling scope adaptor for PCs. Having covered the design philosophy and circuit operation, the author now progresses to its construction, setup and testing. He also discusses the companion DOS and Windows-based software.

by David L. Jones

CONSTRUCTION OF the new DSO Adaptor is relatively easy, thanks to the use of one large PCB which holds all of the electronics. Only the front panel controls, connectors and transformer are mounted externally.

All components including the PCB and mains transformer are neatly housed in a plastic instrument case measuring 260 x 180 x 65mm. An aluminium front panel is used to hold all of the controls. The rear panel can be either aluminium or plastic, and holds a fused IEC mains input connector and D25 IDC connector.

With the high input impedance of the analog section, it is very easy for the first buffer amplifier to pick up noise from the external environment — and to a lesser extent, the

internal digital electronics. To prevent this, it is recommended that a blank earthed PCB be mounted under the analog section of the PCB, as was done with the Mk2 design. This process will be described later. The prototype did work very well without the earthed shield however, with only one or two bits' worth of noise at most. But this will vary between environments, and the shield may be an absolute necessity in some cases.

Start assembly by inspecting the blank PCB. The PCB is relatively large and complex for a single sided board, and five minutes spent inspecting it at the start could save a lot of time later on. Check for the usual problems such as hairline cracks, shorts and solder bridges. Solder masked PCBs have a lower likelihood of problems than unmasked PCBs, but do look

for hairline shorts under the solder mask.

Begin by installing all of the wire links. It pays to take a bit of time to cut and bend the wire to the correct size before inserting. This will allow the wire to sit flat against the PCB, and provides a neater finish. Note the angled link between REG2 and RLY4.

If you only require one channel and wish to save money, then it is only necessary to build up channel 1 on the PCB. However, I recommend that you install all of the passive components and IC sockets, so that upgrading to a dual channel version at a later stage is simply a matter of installing the additional ICs and relays. The passive components and IC sockets will only add a few dollars to the cost, and are a worthwhile investment.

Install all of the resistors next. The two

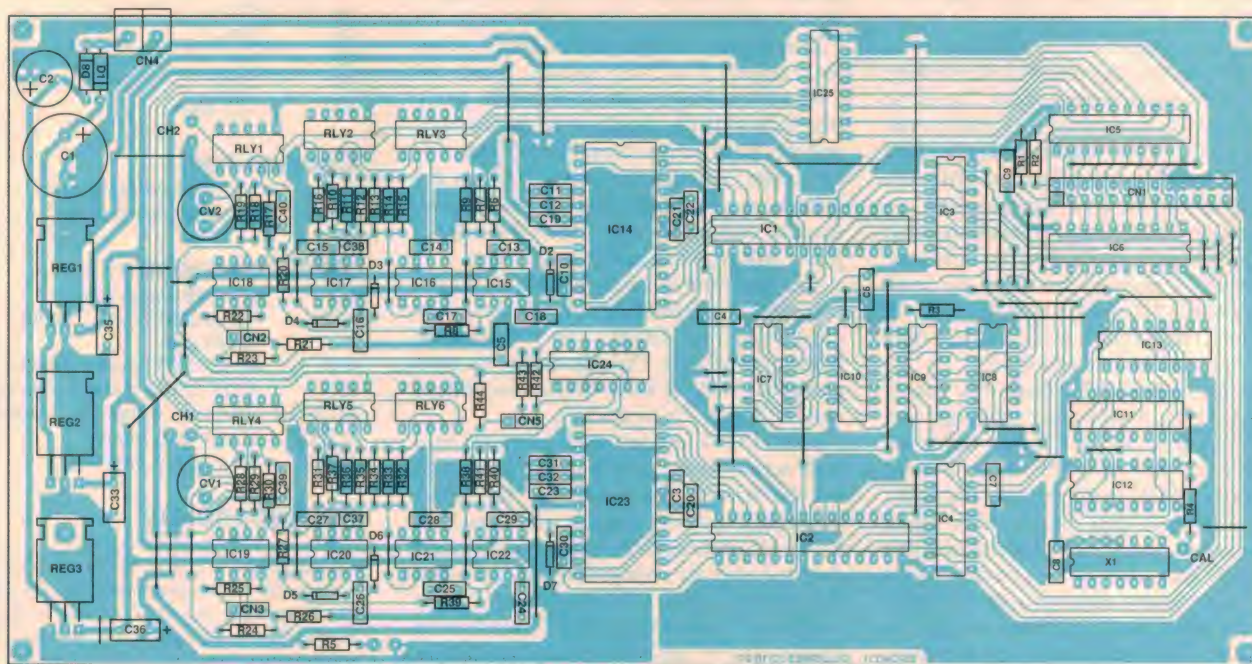
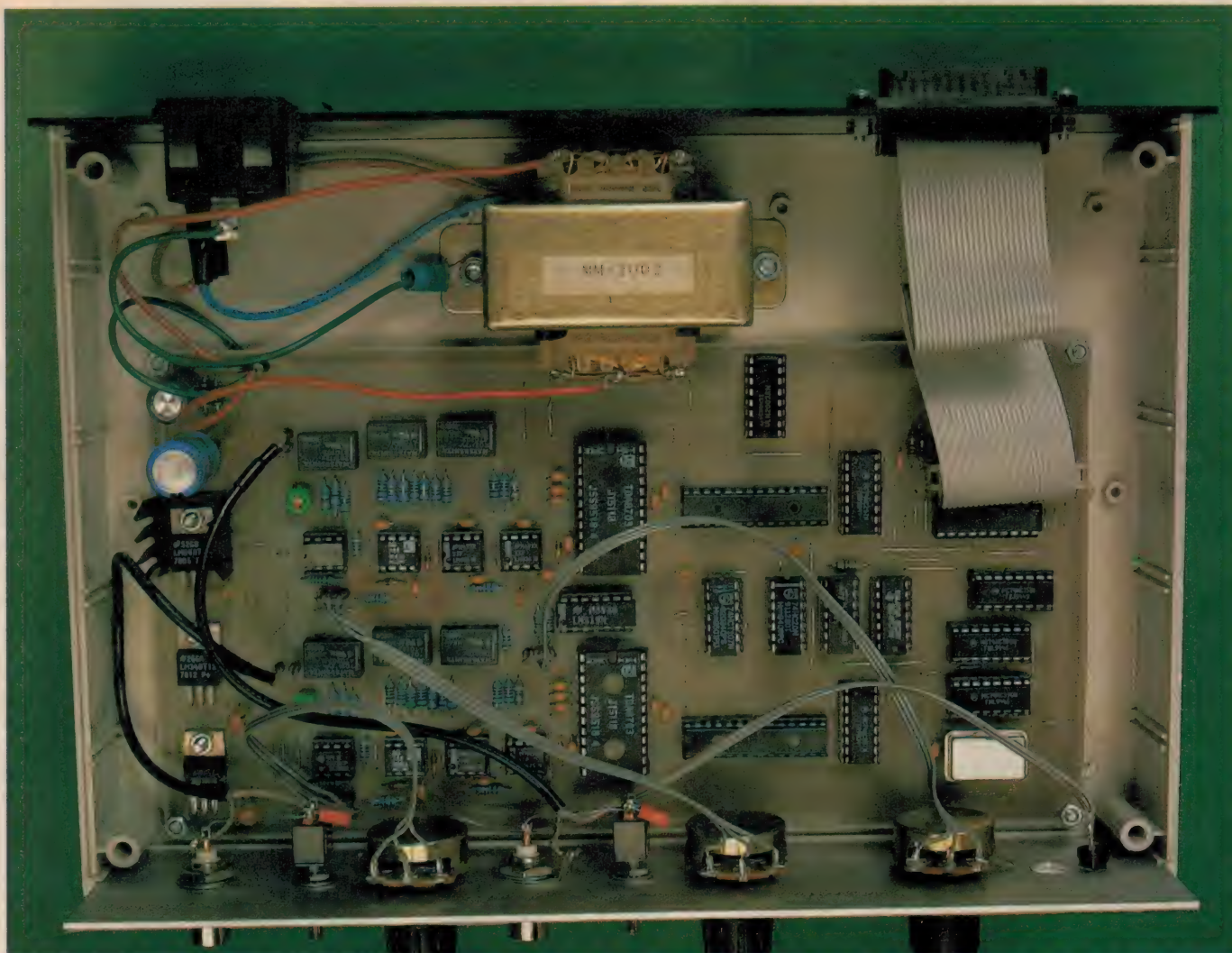


Fig.1: The overlay diagram for the DSOA printed circuit board, which supports virtually everything except the front panel controls and connectors, and the power transformer.



analog channels are fairly well duplicated on the PCB, which makes it easier and faster to install the resistors.

Next install all of the IC sockets. It is recommended that sockets be used for all IC's, as this makes troubleshooting much easier at a later stage. It also allows you to borrow an IC for those occasions when you've run out of 74HC390s, at 10 o'clock at night!

Use two 14-way sockets for the 28-pin FIFOs, as these are cheaper and more readily available than 28-way skinny DIP sockets. For long term reliability, dual-wipe or machine pin sockets are recommended. The single-wipe variety cause more trouble than the small cost saving is worth.

All of the small capacitors can be installed next. Pay particular care to solder bridges when installing bypass caps, as the power rails are close together at these points, and any short will be difficult to find later.

Install all of the PCB standoff pins next. Ensure that they are upright and protrude all of the way into the board before soldering. Then install the 26-way pin header. Use the 26-way IDC header connector to hold the pins in posi-

tion when soldering. This will stop them from moving and ensure they are aligned.

Install the rest of the components, leaving the electrolytics and tantalums to last. When installing the capacitors, be sure to observe the correct polarity as marked on the overlay. The regulators should be bolted to the PCB before soldering, to prevent cracking the joints. Do not install the ICs yet.

Preparing the case

YOU CAN NOW turn your attention to the mechanical side of things. First it is necessary to drill the holes required for the transformer and PCB standoffs. I recommend that you mount the transformer on a metal base plate, and then secure the base plate to the case with four standoffs. This helps prevent the transformer from coming loose if it is ever accidentally overloaded and becomes hot. Securely earth the transformer case via one of the flanges. Be sure to scrape off any enamel coating to ensure a reliable connection.

As mentioned earlier I recommend that before securing the PCB to the case, an earth shield is installed on the bottom of the case.

This shield can be made from a blank piece of copper-clad PCB, approximately 100mm by 100mm. Solder a wire from the blank PCB to the ground track at the top left corner of the DSOA PCB. The shield should be mounted copper side up on the bottom of the case, under the left hand side of the PCB which contains the analog circuitry.

If you are using small PCB standoffs and there is any risk of the shield touching the bottom of the PCB, then cover the blank copper shield with insulation tape. For best results, the copper shield should be as close to the bottom of the PCB as possible.

If you do not already have a pre-drilled front panel, then use a photocopy of the front panel overlay as a guide to the hole centres. After drilling, apply the front panel label.

Attach all of the front panel pots, connectors and switches. Do not use insulated BNC connectors, as the connectors are used to provide the ground connection to the front panel — which is required to reduce noise. The front panel is relatively simple to wire up: there are just three pots, two switches, and one LED.

The only wires which carry high frequency signals are the two inputs coming from the AC/DC switches, and these require coaxial cable for shielding; small diameter coax such as RG-174 is recommended. The other wires only carry DC signals and do not require shielding.

Do NOT connect the front panel to mains earth. Because the ground connection on the PC parallel port is connected to mains earth inside the computer, the front panel is effectively already earthed. Connecting mains earth to the front panel from the mains input on the DSOA can create earth loops and cause problems.

Follow the wiring diagram when wiring up the front panel. Note that C100 and C101 are mounted directly on the back of switches S4 and S2 respectively.

Finally, make up the D25 ribbon cable used to connect between the PCB and the back panel. Attach a 26-way IDC header connector, and a male or female IDC D25 connector to either end of a 150mm piece of 25-way ribbon cable. You could have a permanent cable attached to the DSOA if you so choose, in which case you will require a male D25 to attach to the computer, and a small 1mm rectangular cutout in the back panel to allow for the cable. If you elect to have a D25 mounted on the back panel, then either a male or female D25 can be used as desired. You will then need the appropriate connecting lead for the computer.

Insulate all mains wiring with heatshrink or insulation tape. If you are using a separate fuseholder, then make sure the active wire from the IEC connector is connected to the end terminal of the fuse holder. This prevents the fuse cartridge becoming live when

changing the fuse.

An external triggering input can be added to the DSOA if desired. This will allow you to use both analog channels and trigger off an external input at the same time. All that is required is to add another BNC to the front or rear panel, along with a SPDT switch to switch between CH1 and the external BNC. Connect the BNC input to one side of the switch with coaxial cable, or tinned copper wire if the switch is close to the BNC. Cut the CH1SIG track running to pin 5 of IC24A and connect a length of coax to pin 5 of IC24A, with the braid connected to the nearest analog ground. Run this coax to the centre of the SPDT switch. Connect another length of coax to the other side of the cut track and the nearest analog ground, and then run this coax to the other side of the SPDT switch. This switch will now select between CH1 or the external input for the trigger signal.

Testing & setup

BEFORE INSTALLING any of the ICs, power up the DSOA and check for correct voltage on all of the IC socket power pins. Remove power and then install all of the ICs. Be sure to observe the correct orientation as shown on the component overlay, and also use proper anti-static precautions. Before pushing down on each IC, ensure that all of the pins are aligned to prevent pins being bent back up under the IC.

Reapply power and check the voltage regulators for correct output. If you have a CRO available, it's worthwhile checking that the voltage regulators are giving a clean output.

Connect the DSOA to the PC's parallel port and run the DSOA_MK3.EXE program.

The test program consists of a single screen with various single key commands listed in the bottom left corner. There are options for incrementing and decrementing the timebase and both vertical channels, trigger polarity, trigger mode, and port address. All options are selectable with a single key press.

From the main screen, select the correct parallel port address. 378 hex is most common for desktops, while 278h is for a second parallel port if you have one, and 3BCh is common on notebook computers.

Connect a sine wave oscillator to CH1 and CH2. The DSOA should be immediately operational — all you have to do is to select the correct timebase setting and vertical range for each channel. Select AutoTrigger and you should see the waveform on the screen; it should be a nice clean sine wave with little or no apparent distortion. (Assuming your oscillator is OK, of course!) Select all timebase ranges and ensure that they are all operational. Check the accuracy of the time/div graticule, although this is crystal controlled and should be correct.

It is important to check the accuracy of each vertical range for both channels, as the accuracy is determined from the resistor values in the analog section, which are all too easy to get mixed up.

Select CH1 triggering and ensure that the trigger level control works as expected. Also check the positive/negative trigger setting for correct operation.

The vertical position controls on the DSOA should move the corresponding waveform up and down on the screen.

Feed a 1kHz square wave into both channels, and you should notice some overshoot or undershoot on the 1V, 2V and 5V ranges. This is normal, and will be corrected by the compensation adjustment to be done now.

There are only two compensation adjustments that need to be set, CV1 and CV2. Only the 1V, 2V, and 5V vertical attenuation settings for each channel are affected. The 100mV, 200mV, and 500mV ranges do not require adjustment.

Adjust the 1kHz square wave input on channels 1 and 2 to give at least four divisions of vertical height on either the 1V, 2V or 5V ranges (it doesn't matter which one). Adjust the timebase to give two or three cycles on the screen.

Adjust CV1 until the CH1 waveform appears as square as possible, with the minimum amount of undershoot or overshoot. Do the same for CH2, this time adjusting CV2.

Your DSOA should now be set up for calibrated operation on all ranges, and ready for use.

Operation

YOU SHOULD HAVE very few problems using the DSOA, as it operates in a manner

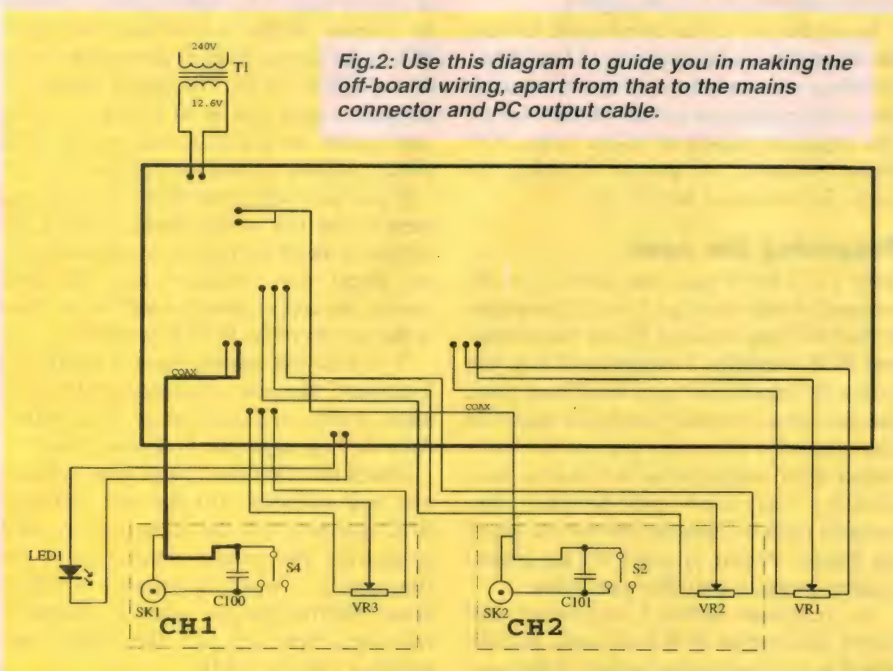
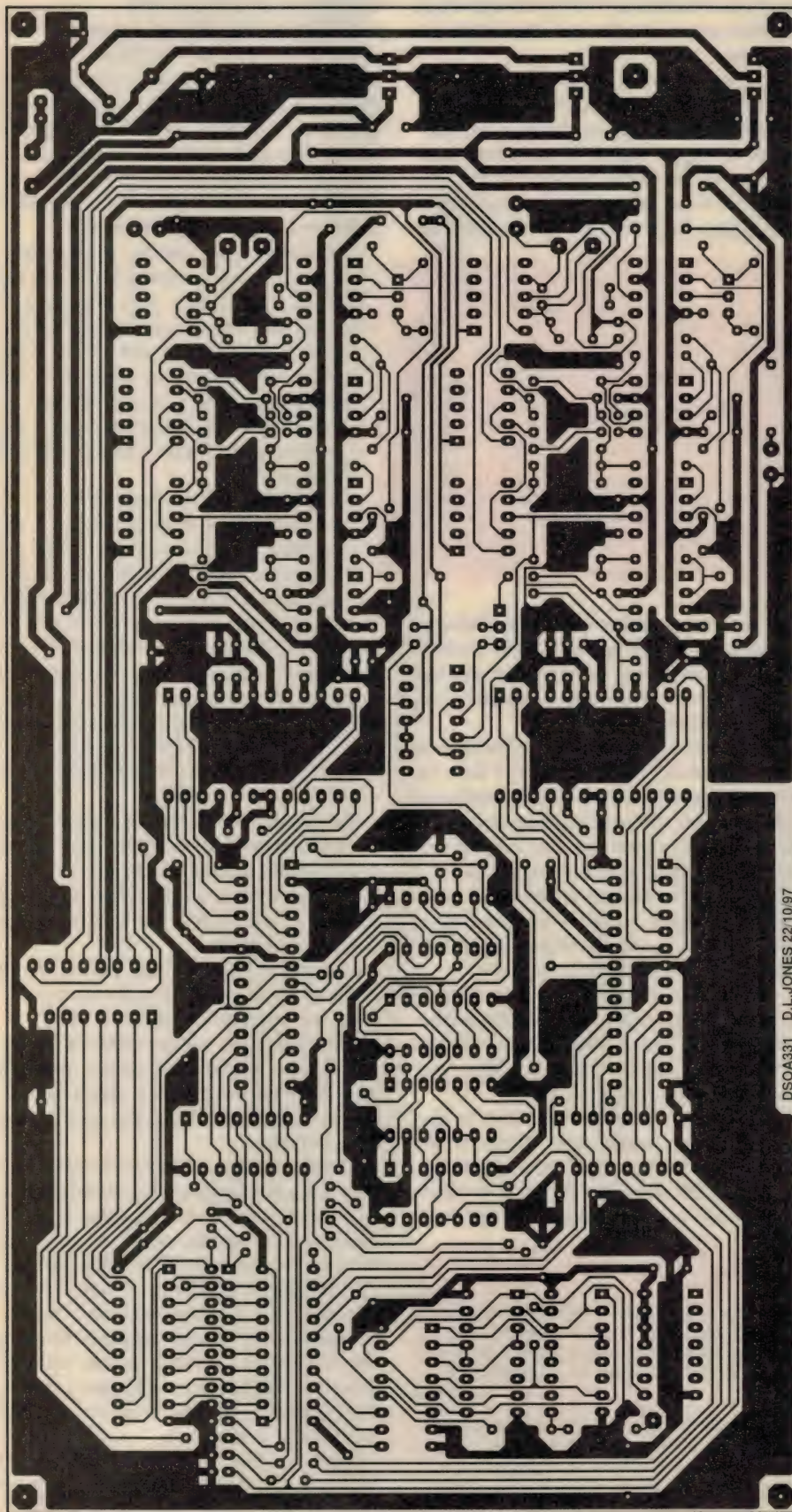


Fig.3 (below) and Fig.4 (right): The PCB copper and front panel artwork for the DSO Adaptor, which can be used to make your own unit. Both are shown here actual size.



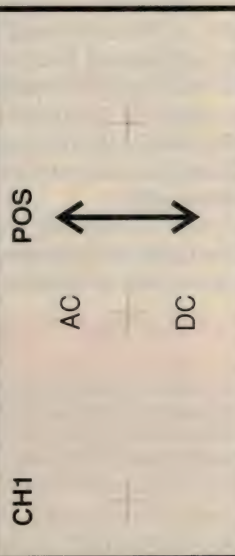
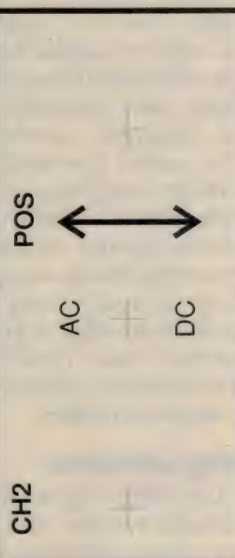
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PC-BASED DSO ADAPTER MK3



POWER

TRIG LEVEL



very similar to an analog CRO. There are of course a few extra benefits — and traps — with a digital storage CRO, which we will now discuss.

A DSO has two major features, one being the ability to capture single-shot events, and the other being the ability to be able to see data before the trigger event (Pre-Triggering). Both features are particularly valuable, and can only be easily obtained with the use of a DSO.

The DSOA has fixed 50% pre- and post-sampling. This means that 50% of the data captured is before the trigger point, and 50% is after the trigger point. The display will always show the trigger point in the centre of the display area. The test program displays all 1024 samples in the display window, which means there are multiple samples per pixel.

One of the major traps when using a DSO is *aliasing*. Aliasing is basically a false display caused by sampling at LESS than twice the highest frequency component of the signal being measured. For instance, when measuring a sine wave the displayed waveform can appear to be correct, but is actually displayed with the wrong frequency. You can see this for yourself by displaying a waveform and then lowering the timebase/sampling rate until the aliasing occurs.

The only way to avoid aliasing when measuring an unknown signal is to start at the fastest timebase range (100ns) and work down. The software will default to the fastest timebase range when loaded.

Matching software

THERE ARE TWO versions of the DSOA control software available. One is a simple DOS-based program that allows basic operation and testing of the completed unit, and the other is a Windows based application with more sophisticated functions. Note that the DSOA Mk3 is NOT compatible with any previous version of the DSOA software. I will briefly describe the DOS software, as it is quite straightforward and you should have little problem using it.

There is only one screen, which consists of a conventional 10x8 division waveform area; the waveforms are displayed in different

colours to aid in identification. The available key commands are displayed down the bottom left of the screen. A short description of each command along with the current setting for that command is shown alongside the relevant key.

There are three modes of triggering in the software — Auto, Normal, and Single Shot. In Auto trigger mode the software will generate a trigger signal if none has been received by the DSOA hardware. If the software has to generate the trigger signal, then the trigger point will not be the same for

WARNING

The inputs on this DSOA project are NOT floating, and are connected to mains earth via the ground connection on the PC parallel port. Therefore, as with any CRO, extreme care should be taken when using the DSOA on earthed equipment. Do NOT connect the ground lead of the CRO probe to any voltage which is referenced to mains earth. Doing so is extremely dangerous and will damage the DSOA and/or your computer!

each acquisition, and as a result the displayed waveform will not be stable. This mode is handy for displaying DC signals or any signal which cannot generate a trigger in the DSOA hardware.

In Normal trigger mode the software does not generate any trigger signal and waits for one to be generated by the DSOA hardware. The software will wait indefinitely until a trigger signal is generated. This mode is useful for displaying repetitive signals that are large and clean enough to provide a stable hardware trigger signal within the DSOA, which results in a stable display. The screen update rate is also faster in this mode.

Single Shot triggering mode is used to capture a single event. When in Single Shot trigger mode, pressing the space bar will arm the trigger circuit, which will then wait indefinitely for the trigger signal.

The current state of the DSOA is displayed in the bottom right corner of the screen. This will show one of three settings: 1. STOPPED when the DSOA is in single shot mode and the trigger has not been

armed. The DSOA will not except a trigger in this state;

2. ARMED when the trigger circuit is armed and waiting for a trigger; and
3. RETRIEVING when the software is reading back the data from the DSOA.

Any signal causing over-ranging on the ADC will be clipped at the top and bottom references, and will be sampled and displayed on screen as such. It is therefore important to remember that any sample point at the top or bottom pixel of the display window could in reality be out of the range of the ADC.

Likewise, the vertical position controls can move the actual waveform out of the ADC range, even though it is being displayed on screen. The ability to move the waveform out of the ADC range may actually be useful in some applications, and if a greater range is required then the series resistors on the position control pots can be adjusted accordingly.

The DOS-based program and its source code in Borland Pascal 7 are available for free downloading from the Electronics Australia Bulletin board and Web site, or by mail via the EA Reader Information Service. It will also be available on the Internet at <http://www.ozemail.com.au/~dljones>. The Windows based program is available from Tronnort Technology — see the accompanying box for further details. A demonstration copy and further details are also available from the Web site just mentioned.

The Windows program has several features asked for from previous users of the Mk1 and Mk2 software, including:

Time and voltage cursors allowing direct readout of the time or voltage parameter between the cursors.

Averaging, which can be set from 2 to 128 averages and is useful for removing uncorrelated noise from a waveform.

A history function, which provides a 'persistence' type display that retains previous waveforms on screen. This is useful for finding intermittent problems over an extended period of time.

A second timebase, allowing you to 'zoom' in on a waveform and scroll from side to side. Waveforms can be saved to disk in either binary or text format, useful for importing the data into spreadsheets for later analysis. The program can also do a direct screen printout to any Windows compatible printer.

Requirements for the Windows program are Windows 3.1 or later, at least 640x480 16-colour VGA screen mode, and a mouse. The program only requires several hundred kilobytes of memory.

That's all there is to the DSOA Mk3. I hope you find it a valuable addition to your test gear. ♦

Software for the DSOA Mk3

Readers who wish to construct the DSO Adaptor Mark 3 are advised that a simple DOS-based program to test and use the project will be available for free downloading from either the author's website, at www.ozemail.com.au/~dljones, the EA website at www.electronicsaustralia.com.au, or the EA Reader Service Bulletin Board on (02) 9353 0627. The program is called DSOA_MK3.EXE, but is compressed with companion files for downloading as DSOA_MK3.ZIP.

As mentioned in the text, a full Windows-based program will also be available for use with the project. This is available directly from the author David Jones, at Tronnort Technology, 12 Copeland Road, Lethbridge Park NSW 2770. Mr Jones can also be contacted via e-mail: dljones@ozemail.com.au. The cost for the program was not available at the time of writing, but it was expected to be less than \$50.

An Upgrade Box for earlier Icoms

by Jim Rowe

Sydney firm Aden Electronics has released its MicoMate, a compact microcomputer-based remote controller designed to enhance earlier Icom receivers and transceivers. It adds modern features such as direct keypad entry of frequency, an additional 99 memory channels and scanning functions — all painlessly and with no mods to the original radio.

MOST MODERN communications receivers and transceivers provide nice features like the ability to feed in your desired operating frequency quickly and conveniently via a keypad, various band scanning modes, plus an array of memory channels to store operating data like frequency, mode, etc. But what if you have one of the earlier models, without such modern frills but still capable of excellent basic operation?

Needless to say there are still a lot of these earlier models in use, by people unwilling to junk them but unable to justify the cost of replacing them with a new model.

Well, there's now an easy and relatively low cost way to give your old rig an upgrade, especially if it carries the name Icom on the front and is one of the models which were at least fitted with a 3.5mm jack for Icom's two wire CI-V serial remote control system. Suitable models are the IC-275, 475, 575, 706, 707, 725, 726, 728, 735, 820 and 821.

As you can see the MicoMate comes in a compact little box (158 x 95 x 33mm), with a 4 x 4 keypad and two line x 16 character alphanumeric LCD screen. There are only two simple cable connections to be made — one to a source of 10 - 14V DC to power the MicoMate itself (it draws about 120mA), and the other to the CI-V jack of the Icom radio you're using it with. (The Icom CT-17 Level Converter isn't needed, by the way. The cable plugs directly into the radio's jack.)

Thanks to its internal microcomputer, the MicoMate provides an impressive list of enhancements to basic radio operation — all accessed via its 16 control keys and using its LCD readout. In fact the MicoMate essentially takes over as the radio's 'front panel', allowing control of most of the main functions. As the cable between the two can be fairly long, this

in itself may be an advantage for some users.

The main features it provides include direct keypad entry of operating frequency and mode; display of current mode and frequency, with a resolution of 1Hz; the availability of an additional 99 memories for storing frequency, mode etc; five further 'scratch pad' memories, to quickly save frequency and mode with a single keystroke (and quickly jump back to those settings, again with a single keystroke); a powerful editing function which allows programming of memories (both those in the MicoMate and those in the Icom radio), even while receiving on the VFO channel(s); the ability to program in frequency offsets, for repeater and satellite communications work; a



A fully assembled MicoMate. The unit provides a range of handy enhancements for earlier Icom radios.

'quick band' function, with the ability to jump to any of 10 programmable frequency/mode settings with a single keystroke; and both memory range and frequency range scanning, between programmable memory channels or frequency limits. Both scanning modes allow selection of nine scanning rates (plus stop), single stepping and choice of scan direction.

In short, the MicoMate can add a lot of very handy modern facilities, to earlier Icom models without them. And all without having to modify the radios in any way...

Incidentally the MicoMate is also easily programmable in terms of the data rate used on the CI-V interface to the radio (1200-2400-4800-9600-19200b/s), and the address

ID of the radio (1 - 99 decimal, or 01 - 63 hex). This means that the one MicoMate can be used with different Icom rigs fairly easily.

Trying it out

ADEN ELECTRONICS very kindly sent us a sample MicoMate unit, so we had an opportunity to try one out for ourselves. As it happens we didn't have an 'older' Icom radio of the type with which it would provide the most enhancements; instead we used it with an IC-R72 receiver, which already sports some of the same features. But it did let us put the MicoMate through most of its paces, and give us a good feel for its features and ease of operation.

Hooking it up gave no problems, and after setting up the MicoMate for the data rate and CI-V address used by the IC-R72, the two were happily communicating.

It didn't take long to get the hang of the way MicoMate's keyboard is used, and soon we were switching frequencies and modes, and also trying out the MicoMate's other control and memory features. A nice feature is that the MicoMate 'beeps' codes to you, to indicate status: one beep means a command has been carried out correctly, three beeps means there was some problem (like a command value out of range, and eight beeps means that there's been a communications problem between the unit and the radio.

Basically it all seems quite straightforward, intuitive and easy to use. Our only small gripe is that because there are no cursor control keys, you often have to key in some leading zeroes when you wish to jump to a relatively low frequency. Presumably that's one of the little penalties from using a low cost 16-key pad...

Overall, though, the MicoMate seems to work well, and certainly provides some worthwhile enhancements for older (and even not-so-old) Icom radios.

The quoted price for the MicoMate in fully assembled and tested form and with the User Manual is \$305 plus \$10 for P&P, including tax. However Aden Electronics can also supply it in kit form, for \$195 plus \$10 P&P, for those prepared to assemble it themselves. Assembly is apparently quite straightforward, with all parts except the keypad mounted on one double-sided PCB.

For more information contact Aden Electronics, PO Box 200, Mortdale 2223; phone (02) 9580 8066, or fax (02) 9579 2098. ♦

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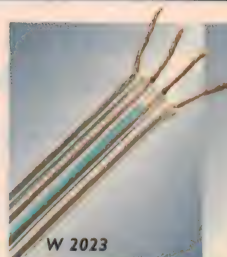


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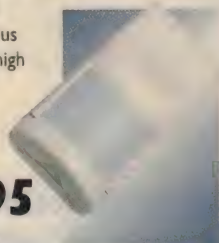
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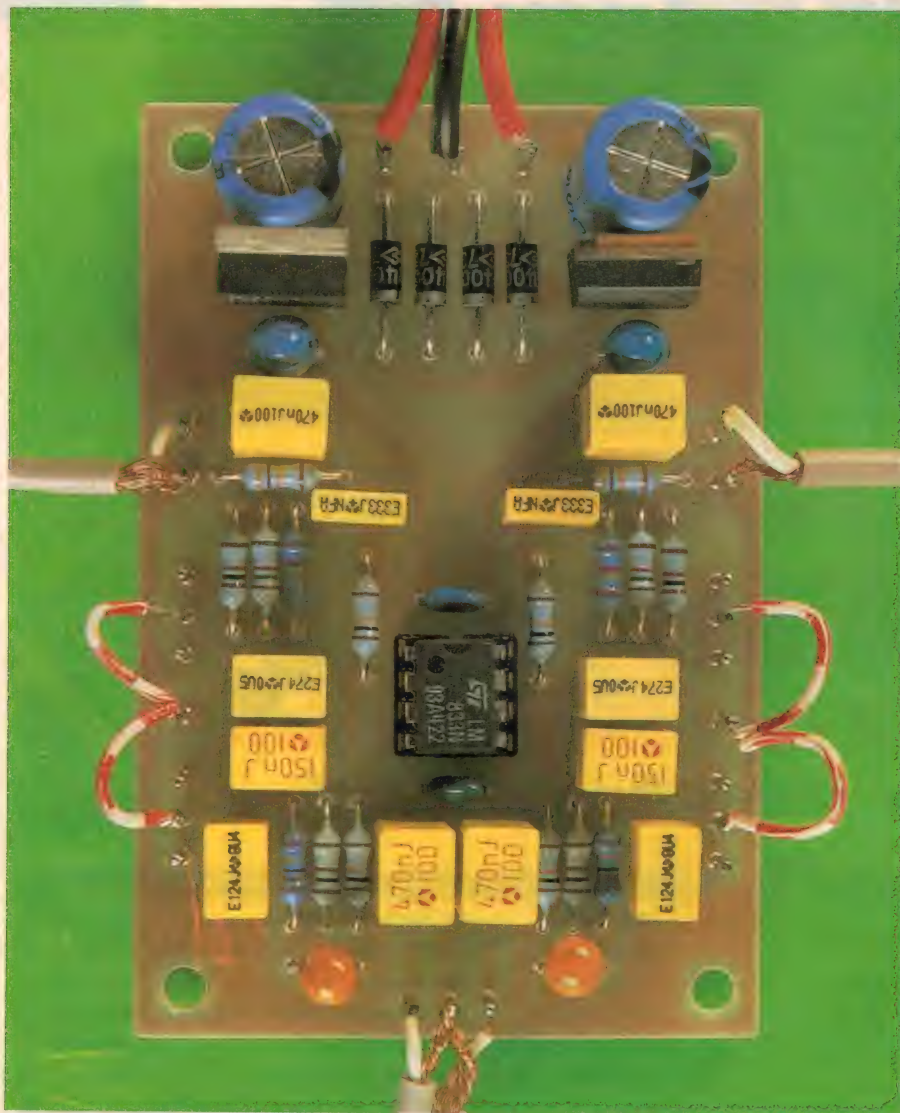


That's where you go!

Preamplifier for Tape Heads

Need a playback preamplifier for a reel-to-reel or cassette tape deck? Here's an up to date design for a flexible, compact and self-contained module that can provide the right gain and equalisation for most applications, based on the high-performance LM833 chip.

by Jim Rowe



NOT LONG after I began experimenting with PC-based digital audio recording recently, I decided to try transferring some of my old reel-to-reel tape recordings to CD. But when I hunted down my old stereo tape deck and dusted it off, disaster struck: although the deck itself still worked, its elderly replay preamps were in a sorry state.

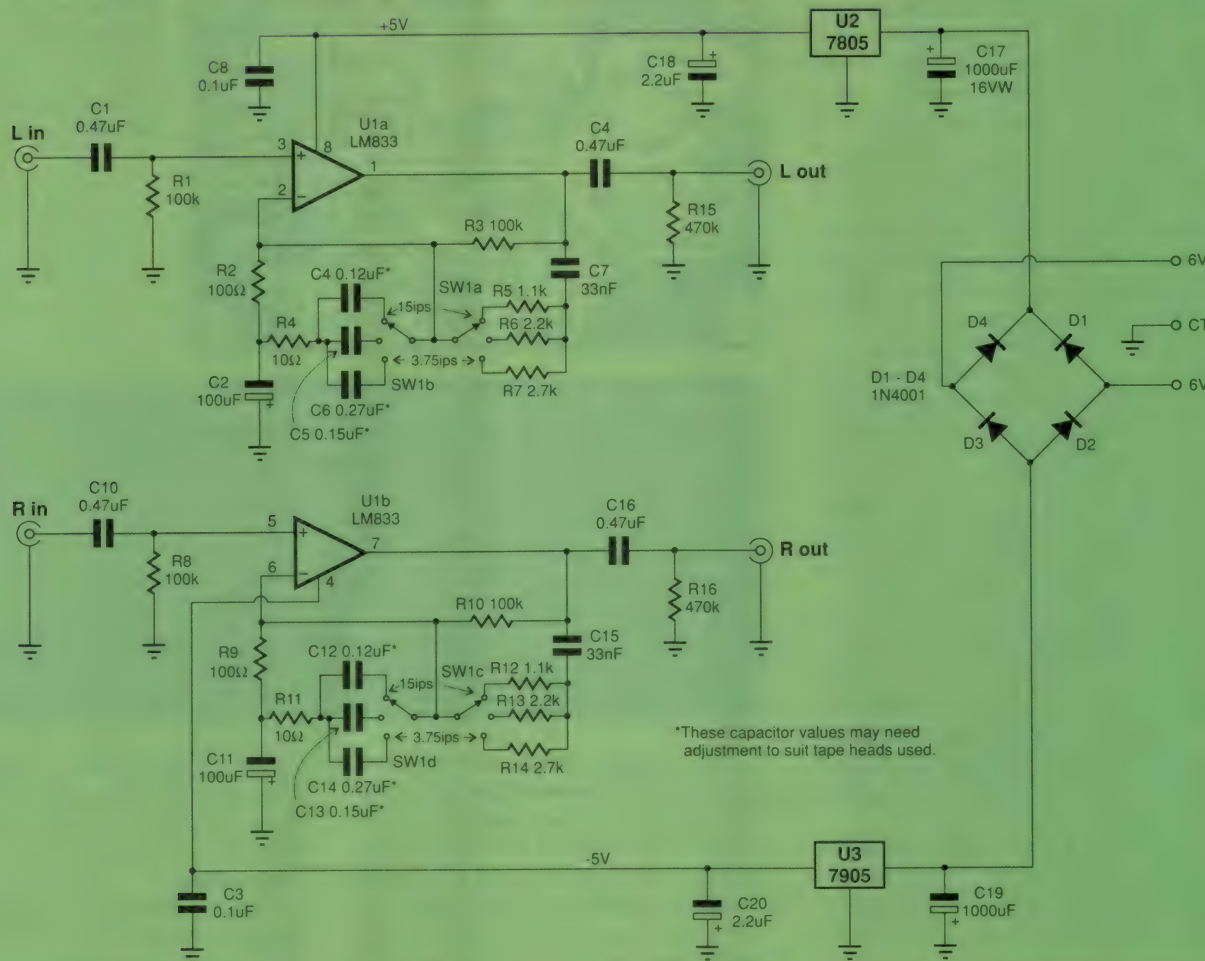
It soon became clear that I would either have to track down and replace a significant number of aged and sick components — or else throw out the complete preamp circuitry and replace it with a modern design. I decided that the best idea was a complete replacement.

Only then, though, did I discover the awful truth: we hadn't actually described a tape head preamp for many years, and as a result there were virtually no preamp kits available nowadays. If I wanted an up to date design, I'd have to produce one myself...

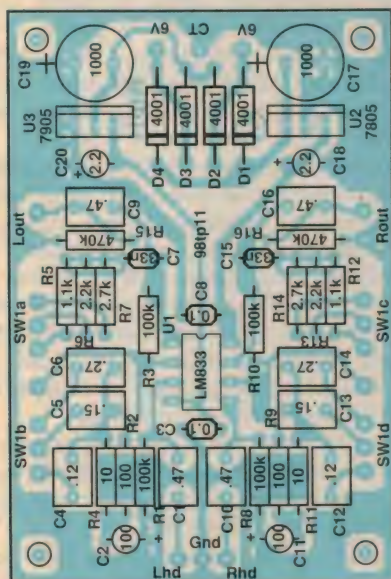
So that's the background to this little project. It arose from a personal need, but having designed and built it (and found that it filled the bill quite nicely) I decided that others might like to take advantage of my effort.

It's based on a modern low-noise dual op-amp IC, and all fits on a PC board small enough to fit inside the smallest two-part aluminium utility box. The circuit can be arranged to provide IEC/DIN (CCIR) or NAB replay equalisation for a variety of tape speeds, and the PCB will accept the equalisation components for up to three speeds. So all you'll need to get going (apart from the

At left is the prototype board, considerably larger than actual size. When this shot was taken it had wire links fitted for 7.5ips equalisation, and the equalisation resistors were not the final values shown in the overlay diagram at right.



As you can see, it's all quite straightforward and based on an LM833 low-noise dual op-amp. The HF boost capacitor values may need adjustment to suit your tape heads.



tape deck and its replay heads) are a very small 12V centre-tapped power transformer, and perhaps a four-pole three position switch to select the equalisation setting you need...

I'm describing just the basic preamp module here, as the case you put it in and the switch you use will depend largely on your tape deck and its case. I fitted the prototype preamp, switch and two RCA output sockets into a standard 102 x 70 x 52mm aluminium utility box (for shielding) powering it from a standard '2851' type 12V/150mA transformer, which was mounted well away from the preamp (and the tape heads!) in the tape deck case.

The circuit

AS YOU CAN see, the preamp is based on an LM833 dual low-noise op-amp chip (U1a-b). The low level input signals from the tape heads are fed to the non-inverting inputs, via DC blocking circuits C1-R1 and C10-R8.

Most tape replay equalisation curves are based on a gain characteristic which falls with rising frequency above a lower 'corner frequency', at a slope of 6dB/octave, to balance the rising output of the tape heads, and

then 'flattens out' at an upper corner frequency, to compensate for losses in the record-replay process. Additional boosting may be used above the upper corner frequency, to compensate for head losses and extend the HF response. In most cases the lower corner frequency is at 50Hz, while the upper corner frequency varies with tape speed — varying from around 4.5kHz for 15ips down to around 1.3 - 2.2kHz for 1-7/8ips (depending on the type of tape used).

To achieve this basic replay characteristic, the new preamp uses a negative feedback circuit employing R2, R3, C2, C7 and switched resistors R5-R7 (and the corresponding components in the second channel). Resistors R3 and R2 set the basic LF gain at 1000 times (60dB), with C2 providing a very low impedance AC path to ground while still blocking DC. Then C7 provides frequency-dependent shunting of R3, to achieve the desired 6dB/octave rolloff slope, while its selected series resistor sets the 'flattening out' level, the upper corner frequency and minimum gain.

What then is the purpose of capacitors C4-C6, and their series resistor R4? These are

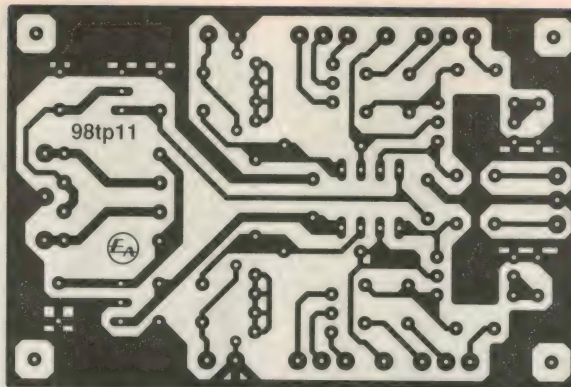
used to provide the 'additional' HF boosting to compensate for head losses. The capacitor values shown on the schematic and PCB overlay are suggested and typical values only, for the three most common 'reel to reel' tape speeds. The optimum values for any particular tape heads are best found by trial and error, but hopefully you can use the values shown as a starting point.

Resistor R4 is included to limit the amount of HF boosting, especially at frequencies above the audio range. This is mainly for stability, to prevent the preamps from 'taking off' at a high frequency.

By the way, the equalisation component values shown on the schematic and the PCB overlay diagram are essentially those for the DIN/IEC (CCIR) curves for 15ips and 7.5ips, and the DIN/IEC/NAB curve for 3.75ips. However the suggested component values for NAB 15/7.5ips and DIN 1-7/8ips (FeO and CrO₂ equalisation) are also shown in Table 1, for those who need them.

The preamp outputs are coupled via C4 and C16, with bleed resistors R15 and R16 used to allow charging of the coupling capacitors even when there is no other loading — and thus prevent 'bangs' when the preamp is connected to another signal amplifier (or the line inputs of the Recording Front End of September, for example).

Power for the preamp comes from a well filtered and regulated $\pm 5V$ supply, with three-terminal regulators U2 and U3 providing the regulation and C17, C18, C19 and



Here's the artwork for the PCB, shown actual size for those who like to etch their own boards. Apart from the power transformer, it will all fit into a standard small aluminium box.

Table 1: Suggested Eq. Component Values

| Curve | R5/R12 | C4/C12 |
|----------------------------------|--------|--------|
| DIN/IEC 15ips | 1.1k | 0.12uF |
| NAB 15 & 7.5ips | 1.6k | 0.15uF |
| DIN/IEC 7.5ips | 2.2k | 0.15uF |
| DIN/IEC/NAB 3.75ips | 2.7k | 0.27uF |
| DIN 1-7/8ips (FeO) | 3.9k | 0.47uF |
| DIN 1-7/8ips (CrO ₂) | 2.2k | 0.47uF |

(Note: Capacitors C4/C12 etc. may need adjustment to suit heads used.)

C20 the filtering. Diodes D1-4 allow the whole thing to be powered from a very small centre-tapped 12V transformer, such as the popular '2851' type. As the current drain is typically only about 8mA, an even smaller transformer could be used if available.

You could even power the module from a centre-tapped battery pack, if you wish. This may be of interest to those who need a preamp which can be used in areas where mains power isn't available. The battery pack would consist of two 9V batteries in series, and simply connected to the board in place of the transformer.

Construction

APART FROM the power transformer, output connectors and equalisation switch (if used), all of the parts used in the preamp and its power supply mount on a small PCB measuring 76 x 51mm, and coded 98tp11.

Assembling it all should be fairly straightforward if you use the overlay diagram of Fig.2 as a guide. It shows where everything goes, although you may not want to fit all of the equalisation components, or change the values shown to suit your particular heads and/or tape speeds.

As usual I suggest you start by checking the PCB for any etching, drilling or solder plating faults. If all seems OK, you can then fit the PCB terminal pins used for the off-board connections; there are 24 of these in all. If you plan to use a socket for the LM833 (U1) this could also be fitted at this stage, although you'll probably get better reliability without one.

Now fit the resistors, which all mount horizontally, and the smaller capacitors: the two monolithics (C3, C8) and the four TAG tantalums — taking care with the polarity of the latter.

Now you can mount the MKT capacitors, and the two larger RB electrolytics C17 and C19 — again watching their polarity. That will have completed the passive parts, so you can fit the four rectifier diodes D1-4, and the two voltage regulators U2 and U3 (making sure you don't swap the two, as well as fitting them with the correct orientation).

At this stage, I suggest that you hook up the PCB assembly to the secondary of the power transformer, apply the power and check that you're getting the correct +5V and -5V supply rails, across C18 and C20 respectively. The two voltages should measure within a few tens of millivolts of the correct figures, if all is well.

If your board passes this test, remove the power again and fit op-amp U1, taking care again with its orientation. Your board module should now be complete, and all that will remain is fitting it into a shield box (possibly with an equalisation selector switch and output connectors), and making the various off-board connections. Then the inputs can be hooked up to the tape heads on your deck, and you should be ready to roll tape.

The prototype preamp is giving excellent results with my old reel-to-reel deck, now that I worked out a way to achieve adequate shielding of the head wiring. In fact it's never sounded so good. Hopefully you'll get equally good results with it. ♦

PARTS LIST

Resistors

(All 0.25W 1% metal film)

R1,3,8,10 100k
R2,9 100 ohms
R4,11 10 ohms
R5,12 1.1k
R6,13 2.2k
R7,14 2.7k
R15,16 470k

Capacitors

C1,9,10,16 0.47uF MKT
C2,11 100uF 3VW TAG tantalum
C3,8 0.1uF monolithic ceramic
C4,12 0.12uF MKT
C5,13 0.15uF MKT
C6,14 0.27uF MKT
C7,15 33nF MKT
C17,19 1000uF 10VW RB electrolytic
C18,20 2.2uF TAG tantalum

Semiconductors

U1 LM833 dual op-amp
U2 7805 +5V regulator
U3 7905 -5V regulator
D1,2,3,4 1N4001 diode

Miscellaneous

PC board, 76 x 51mm, code 98tp11; 24 x PCB terminal pins. Options: 4 pole 3-position rotary switch (SW1); PCB mounting pillars; two RCA output connectors; shield box; 12V(CT)/150mA power transformer, etc.

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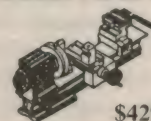
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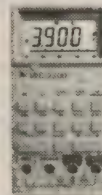
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Moffat's Madhouse



Sounds Pretty Good!

A INFORMATION FROM this week's *Newsweek*: big band jazz, and swing dancing to go with it, are back with a vengeance. We're talking 1940s music being pushed 50 years into the future, and generating swarms of followers — almost always of youthful vintage.

As a result, many kids are deserting the nightclub scene (usually illegal anyway, for those of tender age); instead they're flocking to alcohol-free gigs held in rented halls. This appears to be a new phenomenon in the USA in general, but in the area near Seattle where I live, I've been playing in a band for these swing dances for the past three years. It's only a four-piece blues band, but now bands four times that size are common — big bands!

A couple of weeks ago I got a super dose of big-band jazz. There's a big jazz festival in Port Townsend every year. For the public there are concerts in an old World War Two balloon hanger, which now seats an audience of 2000. And after the concerts, everyone gravitates downtown to hear the same performers playing in various pubs.

Besides the general public, the festival caters for musicians who want to get a week of intensive instruction in a workshop setting, under the watchful eye of the musos who perform for the public. At the end of the week the students get to strut their stuff, in small combos and in two 16-piece big bands.

This year I was hired to be the sound guy for concerts in the American Legion Hall (same as the RSL in Australia), so instead of the usual rock or folkie-type groups, I got to flex my muscles with two nights of big bands. But since there are gigs going on all around town after the festival, I was only allocated one small powered mixer, a couple of ElectroVoice speakers on stands, and three microphones — to cover reeds, brass, rhythm, and a piano!

I've presided over a few big-band recordings before, and it's been my practice to plant a pair of microphones out in the audience, about a third of the way back, and sep-

arated by three metres or so. You then depend on the conductor to get the balance of the sound right, and you end up with a nice stereo recording with all the acoustic colouring heard by the audience.

This time around, I learned that different conductors have their own ways of doing things. The star of the weekend concerts was a conductor named Clarence Acox, a James Earl Jones lookalike and director of Seattle's Garfield High School big band — which wins the top awards every year, all over the Pacific Northwest. On the Friday night, he brought his whole band to Port Townsend (see photo).

They were all dressed in spiffy matching tee-shirts, and they sported 1940s-style music stands, each displaying the band logo. They marched into the hall, all professional and business-like, and took their seats. Then Clarence counted off — "One, two! One, two, three, four!" and there issued forth a blast of acoustic energy that shook the very walls.

Then, as I tried to clear the ringing from my ears, I wondered "What do they need a sound system for?" I soon found out. The piano, for one thing; it had no hope of being heard over the power of that band, until I

"It worked, but it looked kinda funny with Clarence dancing around with his mic stand and me jumping around trying to figure out which fader to open."

shoved a mic deep inside the bowels of the piano and cranked it up to just below the feedback level. Then it blended in nicely with the rest of the band; problem solved.

The other two microphones were in front of the band, one on each side, so various soloists could parade forward, wait for their cue from Clarence, and let 'er rip. Then I'd open the mic, hoping the solo could be heard without blowing the audience off their seats.

This whole procedure got better for me with practice, and by the end of the night it almost seemed like I knew what I was doing...

The Saturday concert featured two big bands made up of workshop participants, three-quarters of whom were kids of high-school age. The remainder were old geezers, mostly retired musicians who just couldn't face putting their instruments down, so they passed their experience and style along to the younger students.

One band was directed by Clarence Acox, and the other by a much more conservative musician named Bob. Bob's preference was for no sound reinforcement at all, although he liked to have one mic to make comments to the audience. As each of his soloists stood up, Bob announced his name. Later Bob decided the second mic should go to the back row with the trumpets to lift their solos a bit.

Since there was no real time to change things, Clarence had to work with Bob's microphone arrangement — one in front, the other in the back, and the piano miked once again.

The students had never met each other before that week; they'd had only four rehearsals as a band, so things were somewhat improvised. Especially the solos. So nobody came forward; instead Clarence grabbed the front mic stand and thrust it at someone, who was then expected to play. It worked, but it looked kinda funny with Clarence dancing around with his mic stand and me jumping around trying to figure out which fader to open.

It occurred to me that what Clarence was doing was treating the sound system as part of his band. And that made me, the guy playing the sound system, one of his musicians. It certainly seemed that way when Clarence turned toward me and gave me a cue to open the mic at just the right instant. It's a similar situation to another group I'm involved with, a string quartet that plays jazz. At their first concert several months ago I miked each player individually, and the director liked the

sound so much she decided they would never again perform unless they had the full sound system, and me to run it. Looks like I've got a permanent gig there...

Speaking of big bands, how many Melbourne readers remember Channel Nine's *In Melbourne Tonight*? That program provided my first job in television. As I remember, *IMT* was on five nights a week. It had a cast and crew of hundreds, literally, presided over by Graham Kennedy. Is he still around? And his female counterpart Rosie Sturgess. And Graeme's sidekick and audience warmer-upper, Philip Brady. I know Philip is around, or was... holding forth on 3AW around the time I moved to the USA. And there was that lovely woman who did commercials — what was her name? A real good-looker...

IMT had banks of writers and producers, continually working to cook up new material; the program ate jokes and sketches like a pig eats slop. (What an unfortunate comparison!) At 2:30 in the afternoon, the *IMT* crew would start work, rehearsing acts, sketches and commercials for that night's show. A few minutes before 9:00, Philip Brady would come out and whip up some enthusiasm in the studio audience, just in time for Graham Kennedy's grand entrance.

My part in all this was as a kind of entry-level audio guy, which meant I got to push the boom around as a more senior audio fellow stood atop it, chasing the performers with his directional microphone. As well I sometimes got to push a wheel-mounted foldback speaker around the studio, so a walking singer could properly hear the band. As I became more senior I got to ride on the boom, while a new flunky did the pushing...

I also became very adept at rolling up mic cables. There was a special way to do this, known as the 'television wrap'. You started with an end in your hand, flicked a loop one way, and then flicked another loop as a mirror image. Back and forth, back and forth, until the cable was neatly rolled up. Then, when you ran out the cable again, it was nice and straight since each loop alternated direction, thus cancelling kinks.

Nowadays, every one of my TV production students at the local high school learns to roll up mic cords using the 'television wrap'. Old musicians teach kids new licks, I teach microphone cord rolling. I can still do

it with my eyes closed.

IMT had a full-time studio band; there must have been at least 20 musicians who came in at rehearsal time and stayed until *IMT*



Clarence Acox conducting the Garfield High School big band.

was put to bed for the night. The band was packed back into the corner of the studio, far away from the main sets and performers. That way the audio operator could control how much of the sound from the band got to air. And that's why the rolling foldback speaker was necessary.

The studio band was never intended to be heard acoustically, only electronically. So, as I remember, there was one microphone for each two musicians, set between their music stands. That meant 10 mics for the whole band, with possibly a further one for the piano. These mics were, as I remember, Telefunken U-67 condenser models. The mics themselves were very small, but each mic was wired through a power supply the size of a shoe box. Their sound was just out of this world.

So you can imagine the jumble of mic cables and power supplies back in the band area. My job was to lay out all the cables at the beginning of each *IMT* rehearsal, then test each and every one with the audio operator to make sure that when he wanted to goose up the trumpets he didn't get saxophones. Then, at the end of each show, late at night, I got to roll up every mic cable from the band, followed by every other mic cable in the studio!

I always wondered why we didn't just leave the cables out, at least in the band area, and simply put the microphones themselves away for the night. But the boss said "roll

'em up", so I rolled 'em up — and then hung each cable on its own special peg.

I must say, the era of *IMT* was certainly the 'good old days'. Wages were cheap back then, yet nobody seemed to be hurting for a crust. So Channel Nine could afford to hire that 20-piece band, full time, five nights a week? And all the studio crew, and directors, and producers, and writers. And they had the nerve to put the whole works to air LIVE!

Nowadays? Pffft! I sit over here in the USA watching the current tonight shows — usually consisting of a rude-mouthed comedian as a host, a couple of has-been celebrities as guests, and not a lot else. I guess it's much the same in Oz now. *IMT* was really the peak of Australian television, in my opinion. Although, they *hated* it in Sydney... wrong town, you know.

And now the circle turns. I may have mentioned before that I've landed a nice new job as coordinator of the local community TV station. One of the things we're seriously considering is a Tonight show in the classic style, live to air.

This town of Port Townsend has more than its share of interesting people and fine musicians, who can hopefully fill a couple of hours a week, at least. I may very well end up hosting the thing, but I'm sure when it's all over I'll still be the one rolling up all the microphone cables. ♦

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Vintage Radio

Aerials, coils and how it all works

My column isn't supposed to be about radio theory, but this month we are looking at the theory of antennas, coils and how a tuned circuit works. Although a pretty dry subject, it's at the heart of any radio receiver — old or new — and a good understanding of the concepts is extremely useful when you're troubleshooting.

VINTAGE RADIO enthusiasts, generally speaking, fall into two categories; those who have some sort of training, and those collectors who are trying to find out the theory as best they can. This month's column is aimed fairly and squarely at the latter. However, a grasp of about Year 10 maths, and an understanding of capacitance and inductance will be required.

Back in the days when men were men and boys were boys, wireless sets were tuned with a good old fashioned 'tuning condenser'. Nowadays, they are tuned with anything from a trimpot to a computer! Jokes aside, even with the sophisticated tuning mechanisms of today, in order to receive a signal we generally must have either a variable inductance or a variable capacitance.

In the vintage radio days this was most often achieved by the familiar tuning 'gang', clearly visible atop the chassis.

Aerials vs antennas

FIRST OF ALL, let's clear up the original difference between the terms 'aerial' and 'antenna'. Although these were later used more or less interchangeably, there was once a subtle difference.

Given a traditional 'inverted L' type of arrangement, or similar, the term 'aerial' used to refer to the horizontal portion(s) of the structure. On the other hand 'antenna' referred to the horizontal and vertical portions, including the 'lead-in'. The terms became interchangeable once balanced-line or shielded downloads tended to separate the functional part of the antenna from the lead-in...

A radio wave travelling in free space is said to have two components: a magnetic component and a electric component. From a purely vertical transmitting antenna — i.e., a 'vertically polarised' antenna, the

electric component radiates parallel to the antenna, and the magnetic component radiates parallel to the surface of the earth. (Tomes have been written upon, and PhD's have been awarded for, the properties of antenna and wave propagation, so this and other explanations appearing elsewhere are greatly simplified.)

The radio wave thus transmitted is said to induce both electric (voltage) and magnetic (current) components into the receiving antenna. A traditional receiving antenna of the inverted L type actually has inductive, resistive and capacitive components of its own impedance. The older texts often referred to a 'standard receiving antenna' as being four metres in height, of 25 ohms resistance, 200pF (0.2nF) capacitance and 20uH inductance. However regardless of the actual figures, the nett result is that there

vibration. If vibrating energy from another source is imparted to the object, at the same natural frequency of vibration, then the object concerned will vibrate of its own accord. The object concerned is said to be *resonating*. The frequency at which this occurs is the resonant frequency. Two good examples of resonance are firstly, air passing through an organ pipe and the pipe sounding its own natural frequency, and secondly, the pendulum of a clock.

In radio, there are a myriad of radio signals in free space, all simultaneously occurring. How then does a radio receiver only receive one at a time? It is because the combination of inductance and capacitance in its tuning circuits will resonate at only one given frequency. In other words when a signal of that frequency excites the inductance and capacitance, a larger voltage will

be developed across them than is produced by any of the other incoming signals. As we tune the tuning capacitor (or more rarely, the tuning inductor), the combination of inductance and capacitance obviously resonates at a different frequency and selects another of the incoming signals.

The term 'Q' refers to the amount of voltage gain that occurs in the tuned circuit at resonance, and also the 'sharpness' of its resonant peaking.

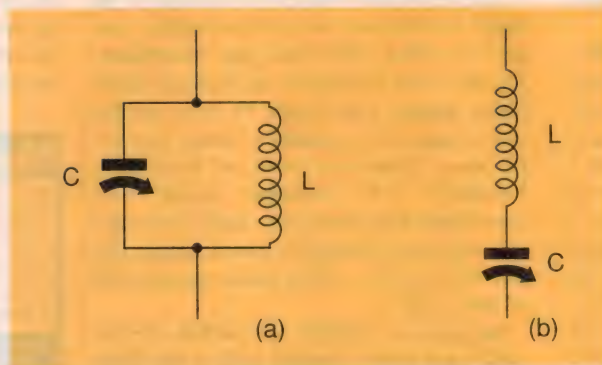


Fig.1: (a) shows a parallel resonant circuit, and (b) a series resonant circuit. The differences are discussed in the text.

is a measurable voltage appearing across the antenna and earth connections of a receiver.

Resonance and 'Q'

RESONANCE is a term which applies in physics, not just radio, and is a difficult concept to grasp. What it refers to is as follows.

Most objects have a natural frequency of

Parallel vs series resonance

MOST PEOPLE are aware of the two ways of connecting an inductor and capacitor for resonance — in parallel or in series, as shown in Fig.1(a) and (b).

In each circuit, resonance occurs essentially when the capacitive reactance equals the inductive reactance; viz. $X_L = X_C$. This gives rise to the formula for resonant frequency,

$$f_0 = 1/2\pi\sqrt{L.C}$$

However, there are differences. In a 'perfect' series tuned circuit, the theoretical imped-



ance at resonance falls to zero. In reality, it amounts to the resistance of the coil. As you move away from resonance in either direction, the impedance of the tuned circuit rises from this value.

In a parallel tuned circuit, although the same formula applies (from a practical point of view) the reverse is the case. Here the theoretical impedance of a 'perfect' parallel tuned circuit at resonance is infinity. But because a practical inductance cannot have zero resistance, the impedance at resonance is never infinity, but very high — perhaps in the order of megohms.

Voltage gain

FIG.2(a) SHOWS just about the universal circuit which couples the antenna to the grid, in a valve-type radio. It's essentially a parallel tuned circuit with the antenna voltage coupling into it via step-up transformer action. However this means that we can redraw it another way, as shown in Fig.2(b). It's now a series tuned circuit in which the EMF from the primary winding acts as a series voltage generator.

Let's assume that the coupled antenna signal, which is now the generator, is say 1mV (0.001 volt) at a frequency of 500kHz. Also that the circuit constants are 405.4uH and 250pF, and the resistance of the inductance is 10 ohms. We'll also use E_c to represent the voltage which appears across the capacitance and therefore between the grid and cathode of the tube.

At resonance, the current in the circuit is $I = E/R$, or $0.001/10$ which equals 0.1mA. By application of the formula for capacitive reactance,

$$X_c = 1/2\pi fC,$$

we find that the reactance of 250pF at 500kHz is 1273.8 ohms.

The voltage across the capacitance is now $E_c = IR$, or $E = 0.0001 \times 1274 = 0.1274$ volts (127.4mV). The 'Q' of the tuned circuit is the amount of voltage gain, which in this case is $127.4/1$ or 127.4. Note that the Q can also be expressed as XL (which is equal and opposite to X_c , at resonance) divided by R , or in this case $1274/10$ — which again equals 127.4.

We can see now a classic example of resonance described earlier. A small 'exciting' signal of 1mV produces 127.4mV across

the tuned circuit, giving a voltage gain is 127.4 times. In a crystal set, 127mV can be enough to operate the earphones, whereas 1mV is not!

So is there 'amplification' in a tuned circuit or a crystal set? Clearly, there is; up to a point! There can be voltage gain, but no power gain.

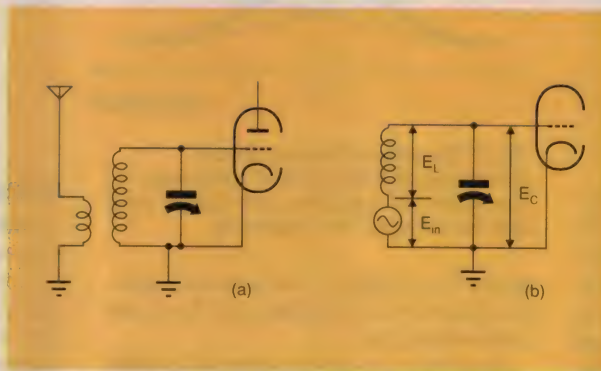


Fig.2: Is the traditional valve radio input circuit in (a) a parallel or series tuned circuit? The resonant grid circuit can be redrawn as in (b), as a series tuned circuit with the voltage induced from the primary as a series voltage generator.

Effect of resistance

IN THE PREVIOUS discussion mention was made of the resistance of the coil. If in the example above the resistance of the coil was only five ohms, the current flowing through the circuit is doubled, that is 0.2mA, and therefore the voltage across E_c is also doubled. This means that the gain or 'Q' of the circuit is doubled as well.

In addition to doubling the voltage gain, the circuit becomes more selective as well. This is about the point where higher mathematics takes over from simple illustrations, so the effect of resistance is best illustrated by the curves shown in Fig.3.

How do we reduce the coil resistance? There are two ways. The first is to use thicker wire for the coils. However, the drawback here is the distributed capacitance which occurs. This results from the sum total of the minute capacitances that occur between adjacent turns of the coil. Even though the coil is continuous, a given single turn of the coil forms one plate of a capacitor, and the next turn of the coil is the other plate of a capacitor, and the insulating

material forms the dielectric.

Coils in receivers of the 1920's tended to be wound on 3" diameter formers with quite thick wire, of about 26swg. Distributed capacitance was considered less of a problem than a higher resistance winding.

The other method to reduce resistance is to use a powdered ferrite core inside the coil former. The ferrite core (or 'slug' as it became popularly known) increases the permeability of the inductance. What this all means, is that fewer turns are required to produce the same inductance as a simple air cored solenoid. Such coils are easily seen in radios of the post war era.

There are other losses that occur in tuned circuits, and are variously lumped together and referred to AC losses.

The 'L/C' ratio

IN THE EXAMPLE used above, the circuit constants for a tuned circuit resonating at 500kHz were 405.4uH and 250pF. If we halved the capacitance and doubled the inductance, we would still have a circuit tuned to 500 kHz. However it doesn't stop there. Consider the alternative situation of a capacitance of 125pF. The capacitive reactance at the given frequency now becomes doubled. It is now 2547.6 ohms.

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So with a current of 0.1mA, the voltage across the capacitance is now doubled. The 'L/C' ratio is said to have doubled.

Hence, it can be seen that for the most efficient and selective tuned circuit we need the smallest practical capacitance with the largest practical inductance.

What is the practical application of this in an ordinary radio? Simply, that as we tune lower in frequency, the capacitance increases, meaning that the L/C ratio decreases, and so does the Q and the selectivity. This is why simple sets, particularly three stage TRF sets without regeneration, tend to suffer a droop in performance at the lower frequency end of the band.

In a simple regenerative 'Reinartz' circuit, the idea of feedback is to overcome the coil resistance and other circuit losses that occur, in order to improve selectivity. In tuned circuits at radio frequencies, the losses are quite complex indeed and amount to more than simple DC resistance. Feedback can reduce the losses considerably, but too much feedback and the circuit oscillates. Again, tomes have been written on oscillators, and the mathematics can be quite complex.

We have seen how the circuit efficiency decreases with increasing capacitance — i.e., as the L/C ratio decreases. Hence, in a regenerative set more energy needs to be fed back to the tuned circuit the lower you tune in frequency. That is why the reaction capacitor needs to be constantly adjusted in these simple sets as we tune across the band.

Antenna coupling

EARLIER WE SAW that there was once such a thing as a 'standard' antenna. Given the constants as described, this would mean that the antenna was in fact a tuned circuit which theoretically resonates at 2.541MHz. It may well do, but it would indeed be so broad that it might not resonate at all!

However the primary winding of the antenna coil shown in Fig.2(a) is also an inductance, and this would add to the overall antenna inductance and lower the theoretical resonant frequency. The tuning properties of the simple bit of wire hanging out the back of a domestic radio can largely be ignored.

In any RF transformer (i.e., pair of cou-

pled coils), the closer the primary is to the secondary, and the greater the number of turns on the primary, the higher is the induced signal — but at the same time,

allow for greater Q. AWA in particular made very very good coils, and the results 'spoke for themselves' (pun intended).

Scanning through the old *Official Australian Radio Service Manuals* shows various ways coil designers have modified their coils over the years to give the intended results. Sometimes they loaded the primaries with a resistor of about 10k, to broaden the tuning. At other times, small capacitors of 4 to 10pF were connected from the hot end of the primary to the hot end of the secondary. This was done to improve performance at the high frequency end of the band. Philips in particular incorporated this design.

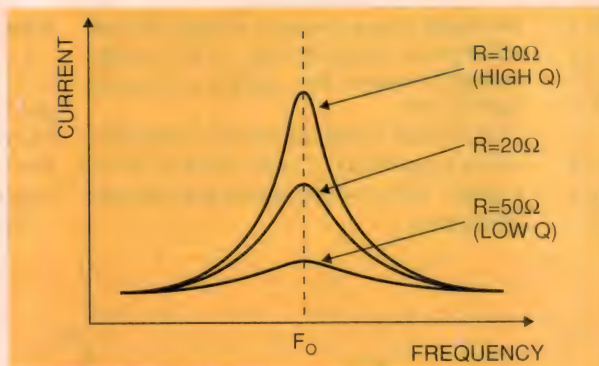


Fig.3: The effect of series circuit resistance on circuit Q and selectivity. The lower the resistance, the higher the Q and the 'sharper' the selectivity.

selectivity is reduced. The larger the antenna, the greater the coupling, but the poorer is the selectivity.

Hopefully you can see from all this that much of the workings of antenna, coil coupling and L/C ratio on the performance of a tuned circuit and its ability to be selective, is all a huge compromise. Too much of one factor means a reduction in another, and so on. One of the joys of early radio enthusiasts was experimenting with their coils for the best results. It still is!

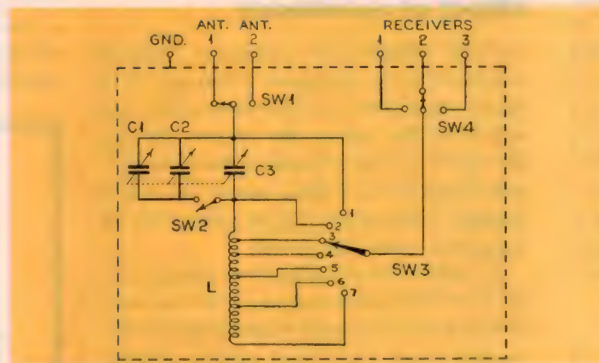


Fig.4: The antenna tuner described in *Radio News* for February 1934.

In the late 1930's, coil designers produced coils of quite sound design that overcame many of the problems. They had a very large inductance primary, which tended to have a resonant peak at about 500kHz. This was to overcome the inevitable L/C ratio losses. They were also wound with Litz wire, to overcome the so-called 'AC losses', and were slug tuned to

Antenna tuners

IT WOULDN'T DO for this column not to have at least one circuit, so we'll do so.

If we wanted to receive only one frequency, we could design an antenna to be very efficient at that frequency and that frequency alone. This what happens in an antenna designed for a transmitter, and many radio amateurs have specifically selective receiving antennas for the given amateur frequencies. However domestic receiving antennas must be more versatile.

One method was to incorporate an antenna tuner, and such a device was published in *Radio News* for February 1934. Its circuit is shown in Fig.4.

This tuner is placed in series with the antenna and the receiver(s), and an improvement of 17dB at 600kHz to 5.1dB at 1500kHz was claimed, with best results using maximum capacitance for the minimum inductance on the coil.

Does this fly in the face of the foregoing text? It doesn't, because this circuit is tuning the antenna, not the incoming signal. It is adjusting the constants of the antenna for maximum compatibility with the aerial coil primary of the receiver. Bear in mind that this device was in the days of simple solenoid coils, and not the better coils of the late 1930s as described above.

For those who are interested, the capacitor is a traditional three-gang type, and the coil is 150 turns of say 22swg enamel wound on a 3" diameter coil tapped at 5, 20, 50 and 100 turns. The former needs to be about 5" in length. It needs to be built in a shielded box, and separately earthed from the receiver. ♦



Information Centre

by Peter Phillips

My nasty gaff about ampere-hour capacity, & more...

First of all, I have to eat a very large slice of humble pie this month for that error I made in the September column. After that, our other topics include a problem water bed, how to disable that annoying 'manual' setting that leaves security lights permanently on after a blackout, websites for more information on digital TV, and a very simple and cheap IR remote tester.

ABOUT THE ONLY gratifying aspect of my incredible mistake in September concerning the ampere-hour capacity of series versus parallel connected cells, is the sheer number of letters and e-mails I've received. While all of them pointed out my error, it's good to know the column is read by quite a few people. So first up, let me agree with all those who took the time and trouble to write.

Yes, as one reader put it, my answer to Ian Darby in the September issue about the 'tiny tube' battery pack was 'utter garbage'. I'll explain shortly how I managed to take a simple problem and confuse myself and others, but first let me give what I hope is now a correct answer.

As the following letter points out, the mistake I made concerns the ampere-hour rating of a cell, which I claimed to be a measure of its stored energy:

You stated that ampere-hour is an energy rating. No, it is not. You must multiply this rating by the terminal voltage to get a watt-hour rating, to represent how much energy is contained in the battery. That is: energy = power x time = volts x amperes x time. This mistake renders all your remaining comments and calculations invalid. (Richard Collett, Melbourne, Vic)

It sure does, Richard! Let's first fix up the example I used in September concerning ten 2V 1Ah cells. Because I confused ampere-hours with energy rating, I said the ampere-hour capacity of a battery is the same if the cells are in series or in parallel. Certainly the energy rating must be the same, but as the next letter says, the ampere-hour rating will

be very different.

I agree that when cells are connected to form a battery, the total stored energy is the sum of the energy stored in each cell. However the ampere-hour rating of the battery can only be a multiple of the individual cells when they are connected in parallel.

Your ten 2V 1Ah cells in parallel results in a 2V 10Ah battery, as you can draw 1Ah from each cell, or 10A for one hour, or 20W at 2V. The same cells in series gives a 20V 1Ah battery, as each cell can still only provide 1Ah. A current of 1A will flow for one hour, but again delivering 20W, the same as the parallel connected cells.

Therefore your 7.2V 380mAh battery pack consists of six 380mAh cells in series, not six 63mAh cells as you suggested. I have to agree with Mr Darby's analysis. (Laurie Collier, email)

Absolutely, Laurie! Mr Darby was indeed correct, and I now need to clarify the ampere-hour ratings of the battery packs used in the tiny tube lights. But first, how come a guy with over 30 years of hands-on experience in most aspects of electronics, covering professional design to teaching, could make such a monstrous error?

It comes down to losing touch with the basics. During the development of the tiny tube lights, I was concerned with all sorts of design issues. So when it came to a simple thing like battery capacity, I guess I locked onto a thought process that led me into one error after another...

When Ian Darby asked me to explain, I had a few moments of doubt, then turned to various books on batteries to confirm my way of thinking. Interestingly, I found nothing about the ampere-hour capacity for batteries made up of cells in series. Finally, convincing myself somehow that ampere-hour capacity was a measure of stored energy, I went on to perpetrate the nonsense that appeared in the September issue.

As many readers pointed out, my 'dissertation' implied it was possible to create energy by simply rearranging the cells. One reader ended his letter saying: *Thank you for giving me the opportunity to make some real money, from the sale of electricity.*

Unfortunately some readers get mighty upset when they come across an error like this in the magazine. One or two have want-

ed me sacked, a few sent me abusive letters, one reader pointed out he had made a similar error some years ago, but most simply pointed out my mistake.

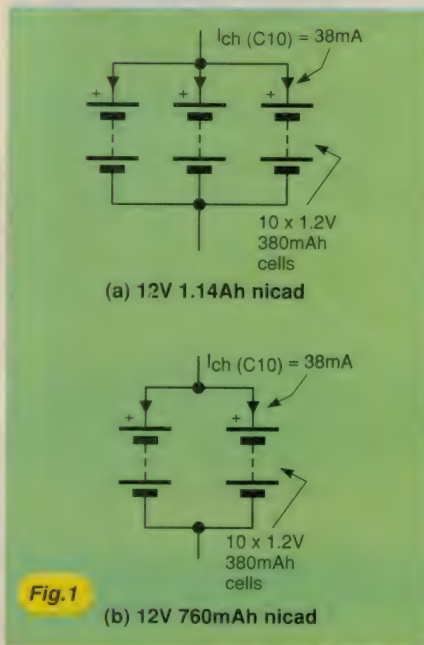
So while I hang my head in shame, I think the end result is what matters. That is, correcting the error by stressing:

- (a) The ampere-hour capacity of cells in series equals the Ah capacity of the smallest cell in the string, or for equally rated cells, the Ah capacity of one cell. The output voltage is the sum of the individual cell voltages.
- (b) The ampere-hour capacity of cells in parallel equals the sum of the individual cell Ah capacities. The output voltage is that of a single cell.
- (c) The stored energy in watt-hours is the same regardless of how cells are connected.

So how does all this affect the tiny tube light projects?

Those battery packs

AS IT TURNS out, my incorrect reasoning was not so far out that it gave wrong charge current values. It did however make my ampere-hour ratings incorrect. The two battery arrangements used in these lights are shown in Fig.1, along with the revised



ampere-hour ratings. The C10 charge and trickle charge currents used in the lights is virtually correct, so the only erratum is the ampere-hour ratings, which are of course less than those given in the articles.

Now let's have a rest from batteries and talk instead about water beds...

Buzzy water bed

The only electrical aspect of most water beds is the heater. But as the next letter explains, strange things can occur even then:

I recently replaced the mattress in our waterbed with one which has a gold coloured metallic-looking outer surface. The bed is made of particle board and is 300mm off the floor. There's a 240V AC flat panel heater under the safety liner (plastic sheet), which is under the mattress. When the heater is energised and one person is on the bed and another standing on the floor, there's a feeling of electricity passing between a single gentle contact between the two people. Increase the tension of the contact and the feeling disappears.

Testing with a multimeter with one probe held by each person gives a voltage reading of around 200V AC. Standing on a mat does not affect the reading, although it does vary between tests, but not by much. Using different people to hold the leads doesn't seem to affect the reading. Touching the probes directly to the bed and the floor gives no reading. My multimeter shows no measurable current.

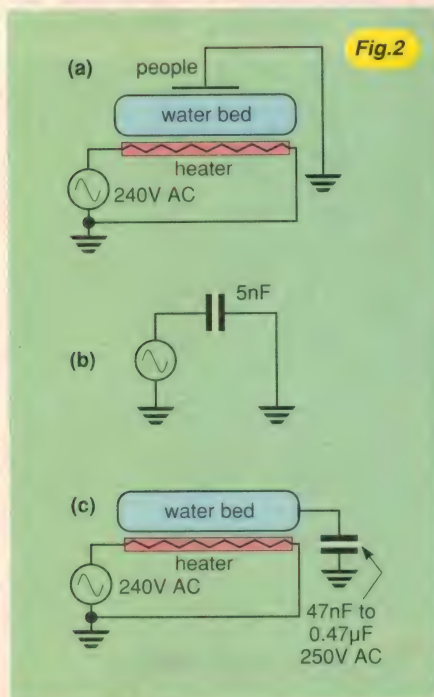


Fig.2

My expertise is in electrical matters rather than electronic, and I am baffled by this, and somewhat worried. Can you explain this phenomenon given the above information? Thank you for a most interesting column in an interesting magazine. I like the format. (Ric O'Donnell, email)

From your description Ric, I've drawn in Fig.2 what appears to be the electrical analogy to your water bed setup. That is, the water bed, heater and persons form a capacitively coupled circuit with sufficient capacitance to cause a discernible current to flow when the circuit is complete. The person lying on the bed is capacitively coupled to the water bed, which in turn is capacitively coupled to the heater panel.

Given that a current below 1mA is just discernible, I've made a rough calculation that the whole arrangement probably has a coupling capacitance of around 5nF, or a capacitive reactance of 500k ohms or more. I suggest there's no real danger here, but it's certainly disconcerting to feel even the hint of an electric shock, especially in bed.

So having analysed why this is happening, now let's move to solving the problem. My suggestion is to earth the water bed through a capacitor of say 47nF or so. You might even try a higher value, up to 0.47μF. I'd use a mains rated capacitor (250V AC), although the voltage across the device should be quite small.

You'll need to be creative in how to connect it to the mattress, but whatever method you use, it should not compromise the insulation between the heater panel and the mattress. Perhaps try a piece of metal foil held against the edge of the mattress with tape, with the capacitor connected between the foil and earth.

If this doesn't solve the problem, I suggest you look for a fault condition, such as moisture tracking between the heater element and the mattress.

IR remote tester

LAST MONTH we looked at using the photo-voltaic properties of LEDs. You might recall a reader reminded us of a Circuit & Design Ideas contribution that used an IR LED (mounted on a BNC socket) to test the output of IR remote control units. However this

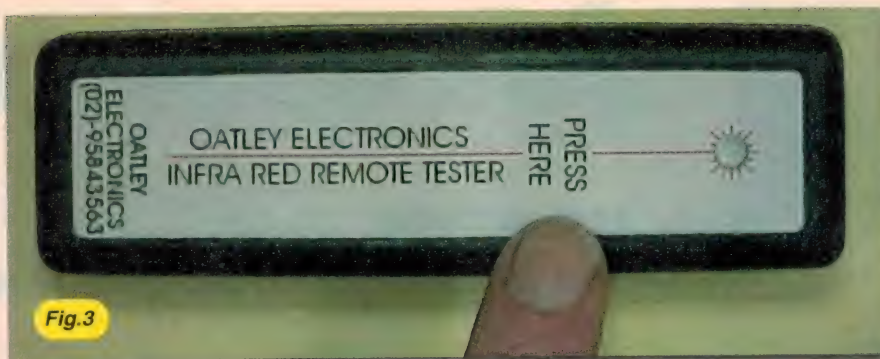


Fig.3

device needs an oscilloscope to see the output, limiting its use to the workshop. But how about a little hand held tester, costing \$4.50!

A photo of the device is shown in Fig.3; it's available from Oatley Electronics. The kit is simple to build and even includes the label. It uses an optical IC device which drives a LED, and is powered by two AAA batteries. The case, PCB and pushbutton are from a disposals transmitter case. To use the tester, simply point it at the IR output from the suspect remote unit, press the tester case at the point shown, press a button on the remote and observe the LED on the tester.

If the remote control unit is working, the LED will pulse on and off with the output signal from the remote. The tester measures around 125 x 37 x 25mm, so it's very portable and small enough to fit in a shirt pocket. If you're interested contact Oatley Electronics on (02) 9584 3563.

Security lights

WE'VE PREVIOUSLY discussed security lights being triggered on by a power supply interruption, but so far we haven't really come up with a simple answer. The following letter is from a reader who, prompted by a number of robberies, has found a way of defeating the so-called manual setting of these lights:

As you know, security floodlights can be set to a permanently on state by interrupting the mains supply for less than two seconds. This is fine if the mains power supply doesn't fluctuate, but here in Melbourne hardly a day passes without some sort of power drop, of usually less than two seconds. Not good if you are away for a few weeks!

I have now investigated the electronics in these lights, and use two to switch on microphones installed in my tool shed. I have done this to protect the shed against burglary, following two successful attempts in which I lost a lot of tools and equipment. The microphone signal is modulated onto the power line and detected in the house.

However, I first needed to find a way to defeat the manual override system. It seems these units are all much the same, or at least work on the same principle. The relay in the

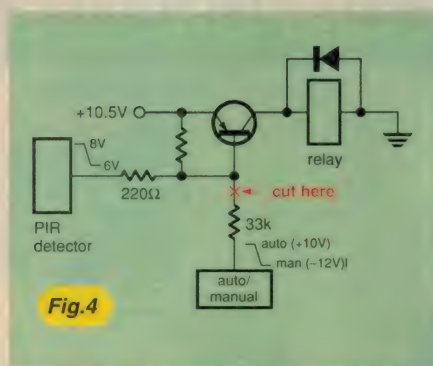


Fig.4

device is switched by a PNP transistor, whose base is pulled up to the emitter (+10V) by a resistor. When the output from the PIR detector section drops from 8V to 6V, the transistor is turned on via a 220Ω resistor. The auto/manual circuit connects to this transistor via a 33k resistor, turning on the transistor when the voltage drops from +10V to -12V. To remove the auto/manual facility, just remove the 33k resistor, or cut its printed circuit track.

Incidentally, the microphone system has since proved successful. At around midnight some weeks ago I heard noises from the mics, suggesting a break-in was in progress. I snuck down to the shed and confronted the burglar, who instantly fled. He was on his own, and probably after the replacement tools from the insurance. My wife says it was rather dumb to do what I did, but I was as mad as could be. And victory was mine! (Wolfgang Melchhart, Westmeadows, Vic)

Congratulations, Wolfgang. Anyone who has been the victim of a robbery will, I'm sure, applaud you for saving your property, and for your ingenuity. The circuit described by Wolfgang is in Fig.4, so assuming most security lights have a similar circuit, we now have a simple modification to remove what appears to be an annoying 'extra'.

However, a word of warning. I've recently replaced a six year old 'security' light and being curious, I pulled it apart to get a feel for its electronics. This unit doesn't have a relay, and instead switches the light with a triac. Like most security lights, the electronics is powered directly from the mains through a capacitor. My point is: take care, as the electronics is usually housed in a rather inaccessible way, and connects (almost) directly to the mains.

This Month's Prizewinner!



Win this great Contrib of the Month Prize!

As an added incentive for readers to contribute to this column, we're now offering a valuable prize to the question judged most interesting, or the answer/response judged most informative, each month. The prize is a Mod-Col 38/54 high-res PAL colour video camera module from sponsor Allthings Sales & Services, with 450 lines of resolution, built-in digital signal processing, electronic shutter and auto gain control — valued at over \$400!

Digital TV sites

THE FOLLOWING letter is in response to my request in June for readers to send me technical information on the proposed digital TV system, due to start in 2001:

Digital TV, yes, I agree it could be an appropriate time to start putting technical stuff in for the benefit of readers. There is actually a wealth of good reference material around, but most of it is all but incomprehensible to most people!

I guess one needs to separate the video digitising and compression from the actual transmission system. Although most people don't see the difference, the transmission system just carries a high speed bitstream in a 7MHz spectrum in the broadcasting bands. This bitstream (19M bits/sec or so) could be anything from 'data', to nine by 2Mb/s TV programs, to one HDTV program — hence the recent bunfight with Pay TV operators.

Of course video compression is another ball game, with MPEG2 the current favourite. We are perhaps fortunate that one of the MPEG 'experts' (Dr John Arnold at the Defence Force Academy in Canberra) lives in Australia. However, as far as I know, Australia has not yet made up its mind on which digital broadcast system to use.

I found the 'Grand Alliance' website at <http://www.atsc.org/standards.html> would allow download of the 8VSB standard being used in the USA. Document A54 is more explanatory than A53, the real standard. The European DVB consortium has a website at http://www.dvb.org/dvb_standards/dvb_standards.htm, although last time I looked, the standards were in draft form, and for sale rather than free. Another site of interest on COFDM is <http://www.tsc.uvigo.es/GTS/BerbeX/cofdmuk.html> (COFDM looks like being used for digital radio too).

While it all seems a little overpowering when looking at the standards for the first time, it really only involves a series of little boxes which carry out some sort of bit manipulation and pass the result on to the next box. (John Kennedy, email, Qld)

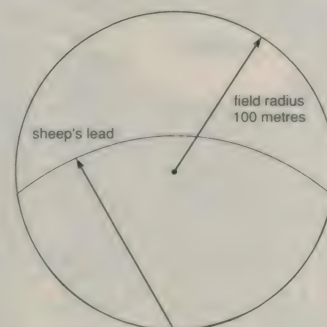
Thanks for your letter and the website addresses, John. I guess it's difficult to examine a system without knowing what system to examine. Still, looking at all available systems gives us the ability to comment when a decision is made.

What???

THIS TIME we ask a sort of 'what's in the black box' question. It comes from Bryan Maher, who seems to have an almost inexhaustible supply of interesting questions. Bryan asks:

There's a very common electronic component, in which the current flowing through the device is proportional not to the voltage, but to the square root of the voltage. That is, if you double the voltage, the current only increases by 1.414 times. Clearly it doesn't obey Ohm's law. What is this component?

Answer to October's What

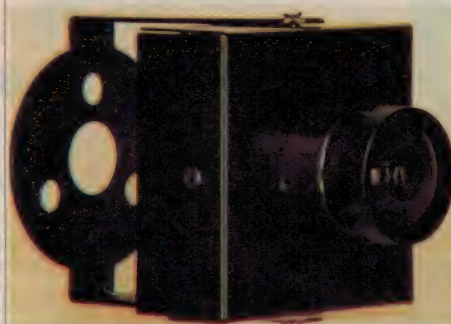


$$4[R^2/2 - 1] \cos^2(R/2) + \pi - 2R\sqrt{1 - R^2/4} = 0$$

where $\pi = 3.14159$ and $\cos^2(R/2) = \text{the angle (radians) whose cosine} = (R/2)$

The answer is 115.8729...metres, or $100 \times R$, where R is found with the equation shown in Fig.5. The equation can be solved using the equation solver in Microsoft Excel '97, or by iteration with, say a QuickBasic program. But perhaps a reader has a simpler method? ♦

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Leo Simpson, *Silicon Chip* Magazine

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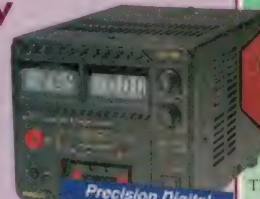
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Features: • Current Speed • Average Speed • Maximum Speed • Trip Time • Trip Distance • Total Distance (Odometer) • 24Hr Clock Time • Countdown Timer & Distance. Supplied with mounting brackets, magnetic pickup, spoke magnet, even the battery! (Valued at \$3.95)

A 1200 Was \$37.95 **NOW \$29.95**



Solder Roll Holder

KEEP YOUR SOLDER TIDY AND HANDY ON THE BENCH!

This handy solder dispenser accepts 200g and 1kg rolls of solder. Can be mounted on wall or bench.

T 1300 ONLY **\$19.95**



INCLUDES BONUS 200g ROLL OF T1100A or T1110A SOLDER! (Valued at \$6.25)

MINI CCD CAMERAS

These mini monochrome CCD cameras are so small, they can be hidden in the most innocuous of places. The RCA video output can be connected to the video input of most modern televisions and VCRs. Perfect for surveillance or security camera applications!

Available as a complete camera with case, lens & connection leads, or as a PCB camera with lens. The S 9100 Audio PCB allows you to listen in as well via the on-board microphone! The audio board simply installs on the camera PCB, and the audio output can be connected to the audio input most modern TVs or VCRs.

S 9000 Complete Camera **\$145**

S 9010 PCB Camera & Lens **\$125**

S 9100 Audio PCB to Suit S 9010 **\$19.95**

M 9516 12V DC Regulated Plugpack to suit **\$28.95**



Great for surveillance or security applications! Ideal for use in a video door monitor. Simple & easy to connect



Intelligent Programmable Remote Control

This learning remote control can replace up to eight remote controls! **Featuring:**
• 8 Different Appliance Modes • 2 Auxiliary Modes • Intelligent Backlighting - Once Activated, dims away after being idle for 5 seconds, saving batteries! (Unlike others on the market) Requires 4 x AAA batteries (supplied). See our 1997/98 Cat. p170 for full details.

A 1000 Was \$199, **NOW \$169**

With Backlit Screen

1-800 999 007 PERTH (08) 9328 1599

OVERNIGHT DELIVERY

PARTS DRAWERS

Excellent for storing all sorts of small items like electronic components, eg. resistors, capacitors, fuses, etc. Other uses could be for storing fishing tackle, pins & needles, buttons, carburettor washers, nuts, bolts & washers, etc. In fact the uses are only limited by your imagination.

Available in three sizes. An infinite number of modules can be dovetailed together both vertically and horizontally to form a storage system that can grow with your needs.

H 0250 Small Size 14 Bays **\$6.50** ea
H 0252 Large Size 14 Bays **\$9.50** ea
H 0254 Large Size 15 Bays **\$9.50** ea

Please note: Components not included

Crimping Tool

This professional quality crimp tool is a fantastic addition to your technical tool kit. With proper care, it will virtually last a lifetime! Suits red, blue and yellow automotive type crimp lugs.

T 1552 Normally \$54,

NOW ONLY **\$39**

150+ Assorted Crimps Kit

10ea 6.4, 4.5, 2.3 Female/Male spade, mini spade lugs, ring terminals, fork lugs, multi-point joiners, 5ea Red/Blue/Yellow inline cable joiners & 5 blue 6.4mm piggyback spade lugs

H 1800
NOW ONLY **\$12.95**

125W MINI INVERTER

AMAZING GRUNT!!

This great inverter provides up to 125W of 240V AC power from your cigarette lighter socket! Just some of the uses are to power televisions, VCR's, lights, small battery chargers, shavers and hi-fi systems. Features low battery indicator, thermal & overload shutdown. Built-in 3-pin plug (no adaptor required). Includes cigarette lighter socket lead.

M 8105 ~~\$159~~ NOW ONLY **\$119**



There are quite a few different 12V to 240V inverters on the market, but few are as compact and as neatly packaged as this one!"
Silicon Chip, April '97

Mini Drill Set

One of the most powerful mini drills we've seen! Great for drilling PCBs, polishing, engraving, etc

A fantastic addition to your tool kit, this powerful mini drill kit includes DC plugpack adaptor, four grinding stone bits, a cutting disc, four chucks (0.5, 1, 1.5, 2.4 and 3mm) and 5 PCB drills (0.5, 0.8, 1, 1.2 and 1.5mm). It's lightweight yet torquey enough to handle some tough jobs! Great for drilling and trimming PCBs, engraving your valuables, model making, polishing gems or jewellery, custom panel work etc.

T 2301 Normally \$69, NOW **\$59**

Ideal for making one-off PCBs or prototypes!

New model now housed in robust carry case and includes plugpack!!

Christmas is just around the corner!

Do your Christmas Shopping early at Altronics and save a bundle!

Phone our Freecall order line on 1-800 999 007 with your order and we'll despatch it post-haste!

POWERHOUSE INVERTERS

Operate 240VAC appliances from a 12 or 24V battery ANYWHERE, ANYTIME!!

Using the latest MOSFET output stage and toroidal transformer these inverters are super efficient and will deliver high surge currents. The auto-start mode enables the inverter to remain connected to the battery (drawing only micro amps) and springs into life once you turn on your equipment, saving precious battery power. Some uses are camping, boating, fishing, mining, farming, & remote settlements.

Features: • Dual AC Power Sockets • Auto-start standby mode • Sturdy rust proof ABS case • Heavy duty battery leads • LED status • Circuit breaker protection (600W & 1200W models)

K 6755 300W 12V Input **\$399**

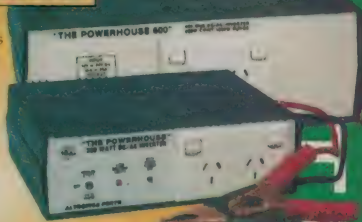
K 6756 300W 24V Input **\$399**

K 6777 600W 12V Input **\$699**

K 6779 600W 24V Input **\$699**

K 6797 1200W 12V Input **\$999**

K 6799 1200W 24V Input **\$999**



All models now include PHASE CORRECTION to run inductive loads, ie. fridges, pumps, small motors, etc.

120W Gas Soldering Iron

AT LAST! A BIG GAS IRON!

This butane powered iron has a HUGE 120W heat capacity.

Features a "one-touch" internal piezo ignition for super-easy starting, and a thumb-wheel heat control. The massive 33cc gas storage chamber is refilled using a standard butane refill canister. A MUST for installers, mobile technicians, on-site service personnel, auto-electricians etc.

SUPER BONUS OFFER! The first 100 callers to purchase a T 2600 receive a roll of T 1100A solder and a T 2447 Butane Refill, together valued at \$11.45 FREE!

T 2600 Normally \$129, NOW A CRAZY **\$89** ea

ONLY 100 UNITS AT THIS AMAZING PRICE!!



WHY PAY \$200 OR MORE for a 17cc tank size when you can have a 33cc for only \$89!

MASSIVE 120W Heat capacity! Simple "thumb-start" piezo ignition refillable gas storage!

Polypropylene Speakers

These fantastic speakers are ideal for replacement speakers or your own designs. Manufactured to our own specifications, these drivers feature low Q, high efficiency and low resonance, all a must for bass-reflex bass enclosures.

| | Watts | | Vas | | This |
|--------------------|-------|------|--------|------|-------------|
| | Max | Qts | Litres | Fo | Month |
| C 3055 6.5" Woofer | 50W | 0.43 | 27 | 40Hz | \$29.95 |
| C 3060 8" Woofer | 100W | 0.32 | 54 | 34Hz | \$59 |
| C 3065 10" Woofer | 100W | 0.28 | 173 | 28Hz | \$79 |
| C 3070 12" Woofer | 150W | 0.17 | 367 | 25Hz | \$99 |
| C 3075 15" Woofer | 200W | 0.33 | 461 | 28Hz | \$139 |
| | | | | | \$95 |



SUPER SPECIAL! SAVE 30%

UpTek Professional Digital Multimeters

These superb meters are ideal for the hobbyist and professional alike. Both feature UL approved fuse protection on current inputs, large high contrast 3.5 digit LCD displays, high quality instrument leads, built-in stand and rugged construction. If you want the best performing multimeter for your dollar, then look no further than these excellent instruments.



Auto Ranging DMM

- 32 Segment Bar Graph
- Manual Override of Autorange
- Incorrect Lead Socket Beeper
- Range Hold & Data Hold
- Auto Power Off
- AC < 320mV - 750V
- DC Volts < 320mV - 1000VDC
- Resistance < 320Ω - 30MΩ
- Continuity Buzzer
- AC/DC Current < 320μA - 10A
- TTL/CMOS Logic Tester
- Diode Check

Q 1104 **\$119**



TRUE RMS 34 Range DMM

- True RMS AC to 5kHz
- Freq. Counter < 2kHz - 20MHz
- Data Hold
- Auto Power Off
- Low Ohms Capability (< 20Ω)
- Zero Adjust on Low Ohms
- AC < 200mV - 750V
- DC Volts < 200mV - 1000VDC
- Resistance < 20Ω - 20MΩ
- Continuity Buzzer
- AC/DC Current < 200μA - 10A

Q 1106 **\$119**

These quality meters include a **FREE** bonus holster + **3 Year Warranty!!**

Micron Soldering Station

The MICRON Series 3 soldering station employs electronic switch mode circuitry in lieu of a mains transformer. Excellent for all general purpose and production soldering. Features: • High insulation ceramic heating element • Rapid heat-up and heat recovery • Heater insulation of over 100MΩ • Zero voltage circuit minimises high voltage spikes & magnetic fields to prevent damage to sensitive devices • Continuous temperature adjustable from 250° to 430°C • Grounded power cord • Selecting the desired operating temperature is as simple as turning a knob. Supplied with Long-Lasting Iron Clad Tip

T 2443 Normally \$149,
NOW **\$99**



NiCad Batteries

GOOD FOR UP TO 1000 RECHARGES!!

NiCads will eventually pay for themselves, and can provide hundreds of recharges if cycled periodically. They can be used in just about any battery powered appliance.

HUGE SAVINGS!!

S 4705 700mAh AA Cell Normally \$2.50 ea,
NOW **\$2** ea, 10 & up, or **\$1.60** ea, 25 & up

S 4710 1500mAh C Cell Normally \$4.95 ea,
NOW **\$4** ea, 4 and up, or **\$3.50** ea, 10 & up

S 4715 1500mAh D Cell Normally \$7.25 ea,
NOW **\$6** ea, 4 and up, or **\$5.50** ea, 10 & up

S 4720 100mAh 9V Cell Normally \$12.95 ea,
NOW **\$8** ea, 2 and up, or **\$7.50** ea, 4 & up



1-800 999 007 PERT

Altronics Fax Order Line: (08) 9328 3487

ALTRONICS COMPONENTS

Fax Order Line: (08) 9328 3487

PC I/O Adaptor Kit

(See EA July '91)
Using this module you can computer control all kinds of things such as security systems, stage lighting, model railways, watering systems etc. The unit simply connects to a standard RS232C serial port on any PC. It has 8 digital inputs controlling 8 outputs. A simple addressing system allows multiple units to be "daisy chained" from a single RS232C port, expanding the number of inputs and outputs up to 64.

Combined, the K 2850 & the K 2852 Allow You to Turn Appliances On & Off with Your Computer!

K 2850 **\$59**
Pluggack to suit M 9664 \$14.50

Input Buffer & Relay Driver Kit

(See EA Feb '89) This is a companion kit for our I/O Adaptor kit (K 2850). It has four relay outputs and eight opto-isolated inputs. This kit contains all parts necessary to construct both the input and output stages. A Qbasic program listing is supplied to help you complete your project.

K 2852 **\$34.95**

Beat Triggered Strobe Kit

(See SC Aug '98) You've seen these in Nightclubs and rock concerts. Strobes add super lighting effects in darkened entertaining areas. It is sure to add tons of life to any party or B.B.Q. Features: • Variable rate and sensitivity for beat settings • Line source inputs for beat triggering • Selectable beat / continuous functions • Simplified construction to it's predecessor • Powered from a standard 240V mains source • MDF box, carpet, robust aluminium reflector (unlike others on the market) and all the necessary components for a single strobe model. Add a second tube option for twice the light!

K 5792

\$159

K 5797 Two tube option \$18.95

Make your next party a real blast!

Sustain Unit Kit for Electric Guitars

(See SC Apr '98) A sustain unit can make your guitar sound a little more "live", by keeping the volume of a note at a constant level while the string resonance dies away. It's one of the most widely used guitar effects (FX), and this simple kit is a fraction of the cost of a commercial unit! It features adjustable attack and decay, a defeat switch and standard 6.35mm input/output jack sockets. Requires a 12V DC power supply. Supplied short form so you can build it into a custom case, if required.

K 5539 **\$27.95**
Pluggack to suit M 9664 \$14.50

Add sustain to your range of guitar FX at a fraction of the cost of a commercial unit!

Masthead Amp Kit

(See EA June '98) Utilising the new MAR-6 Wideband Amplifier IC, this masthead amp will boost the gain of incoming signals into your TV or FM radio, improving reception in weak signal areas. It is suitable for UHF, VHF & FM signals and reduces noise, snow and hash. Requires 9-12VDC pluggack. Includes waterproof masthead housing for external mounting.

K 1795 **\$39.95**

12V Pluggack to suit M 9660 \$13.50

Improve the reception to your TV or FM radio with this kit

12 & 24V "Dual Mode" Battery Charger Kits

(See SC Oct '98) One of the most glaring problems associated with inexpensive commercial chargers is that you cannot leave the battery connected to them for longer than necessary. Doing so causes a fire risk not to mention reduces the life of your expensive battery. This unit powered by 240V and will charge a flat lead acid battery at 2A until the battery is at full charge. The battery charger will then keep the battery topped up by maintaining a small current (0.5A) to the battery. Supplied with all the components and an attractive housing.

K 4225 12V Model **\$49.95**

K 4226 24V Model **\$59.95**

Excellent Christmas present for Dad!

"Wa-Wa" Pedal Kit

(See Sept. SC '98)

The electronics of the "Wa-Wa" pedal shapes the guitar's output waveform to produce a "Wa" sound. Stepping on the pedal will vary the amount of "Wa" introduced into the guitar's output. This project contains all the parts required to construct the electronics portion of the pedal including the slider pot for the pedal housing and information on how to construct your own pedal. Features: • Virtually noise and hum free • Band Pass frequency: 50Hz to 2.8kHz • Bandpass Q: 4.35 to 4.76 from 100Hz - 20kHz • Bandpass adjustment with VC 16% • Bandpass frequency linearity with control pot <5% • Maximum input signal 220mV RMS • Frequency response -3dB @ 47Hz and 2.8kHz • Signal to noise ratio 78dB with 20Hz - 20kHz filter (at max input) • THD 0.3% @ 1kHz and 200mV input

K 5533 **\$34.95**

12V Pluggack to suit M 9664 \$14.50

NEW!
Produce the sound that made Jimmy Hendrix famous with this inexpensive "Wa-Wa" pedal

Audio Pre-Amp for PC Sound Card

(See SC Sept. '98) As we all know tapes and phono players require equalisation that is not included in the software for burning CDs. This project provides stereo equalisation for tape/phono and microphone, plus basic mixing functions. Features: • Line output: 2V p-p RMS @ 1kHz • Low Noise Magnetic Pickup preamp: full RIAA eq. 35dB gain @ 1kHz, input impedance 50k • Low Noise Microphone Preamp: selectable total effective gain of either 60dB or 50dB to suit microphone output. Response is flat within 2dB from 35Hz - 18kHz, input impedance 100k • Independent tape/line and microphone level controls, bass and treble controls, providing 12dB boost or cut @ 50Hz and 15kHz. • Attractive black powder coated sloping console case

NEW!

If you have a CD-ROM "burner" in your PC and a sound card you can make your own CD's.

K 2880 **\$99**
12V Pluggack to suit M 9664 \$14.50

Gear Change Indicator Kit

(See SC Sept '98)
Modern race cars have indicators to tell drivers when it is time to change gear and this can vastly improve racing times. The project provides an audible and visible indication that it is precisely the right time to change up a gear. Features: Adjustable change times (suits up to 5 spd g/box) Supplied shortform with no case

K 4050 **\$37.95**

YES! We Now Accept Diner's Club and American Express Cards!!

ALTRONICS

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Standard Delivery & Packing Charge: \$4.00 to 500gms, \$5.50 500gms-1 kg, \$8.00 1kg-5kg. Where possible we process your order the day received and despatch via Australia Post. Allow approx 9 days from day you post order to when you receive goods.

Overnight JetService: Up to 3kg is \$9.50, 3kg to 5kg is \$16.00—We will process your order the day received (if placed before 2.00PM WST) and despatched for delivery the next day. Country areas please allow an additional 24-48 hours.

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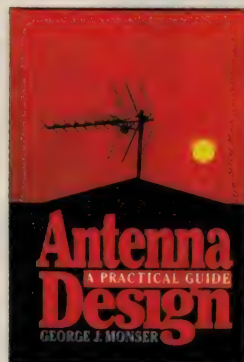
Prices: Please note, Normal RRP rates quoted are current selling rates and may vary slightly from catalogue pricing. (Primarily due to the softening of the A\$). **Heavy Service:** All orders of 5kgs or more must travel Express Road—Please allow up to 7 days for delivery. \$12.00 to 10kgs. \$15.00 over 10kgs. **Insurance:** As with virtually every other Australian supplier, we send goods at consignee's risk. Should you require insurance cover against loss or damage please add \$1.00 per \$100 of order value (minimum charge \$1). When phone ordering please request "Insurance". **Altronics Resellers:** Chances are there is an Altronics Reseller right near you—check our catalogue list or phone us for details of the nearest dealer. Blue Ribbon Dealers are highlighted with a ●. These dealers generally carry a comprehensive range of Altronics products and kits.

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New Books

Designing antennas



ANTENNA DESIGN: A PRACTICAL GUIDE, by George J. Monser. Published by McGraw-Hill, 1996. Hard covers, 236 x 158mm, 163 pages. ISBN 0-07-042843-3. RRP \$160.

More than most areas of RF electronics, the design of antennas always seems to have a large 'leap of faith' between the

basic theoretical foundations and the actual production of efficient real-world products. Small wonder that many people — even those working in other areas of RF engineering — often describe antenna design as a 'black art'.

The author of this book is an antenna design engineer with 35 years of practical experience and 18 patents to his name, and this is his attempt to help newcomers to antenna design 'bridge the gap' between theory and practice. It's fairly slim and the style is fairly brief/concise, but then it's meant to be a practical design guide rather than a full-coverage textbook.

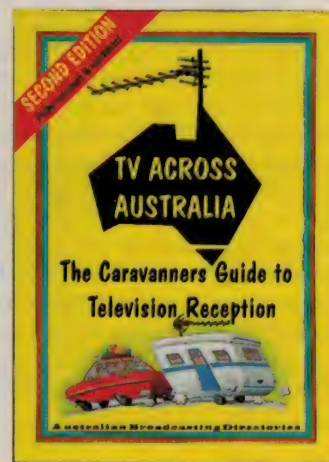
The emphasis is on evolving a practical antenna design for the chosen application, efficiently and in a real-world manner. There's a minimum of complicated maths, and quite a bit of guidance on design and evaluation procedures, problem solving and design optimisation for production.

It's mainly going to appeal to engineers trying to get started in antenna design, but for these people it should be quite valuable.

The review copy came from McGraw-Hill Book Company Australia, PO Box 239, Roseville 2069. (J.R.)

Mobile TV reception

TV ACROSS AUSTRALIA: The Caravanners Guide to Television Reception, by Robert R. Haverfield and Margaret M. Haverfield. Second Edition, published by Australian Broadcasting Directories 1998. Comb binding, 297 x 220mm, about 160 pages (not cumul. numbered). ISBN 0-9585271-0-5. Price \$21.95 plus \$3.50 P&P.



About two and a half years ago, I reviewed the first edition of this handy TV reception guide for caravanners, and I gather it has been very popular. Which is not surprising, because as I noted back in 1996 it provides a valuable and handy 'user friendly' reference on Australia's TV stations, for almost anyone — not just 'mobile viewers'.

This new edition has been fully revised and updated, with quite a lot of new features including information on the country's current 2073 stations (6% more than the first edition) and planned 168 future stations, coverage distance figures as well as regional maps, 80 'helpful hints' on TV reception and antennas (up 30% from last time) and 40 Technical Topics on TV basics.

It's all presented in a very readable and accessible fashion, and there's even some useful information on digital TV. So even more than with the first edition, it should be of great value as a practical reference and guide — for almost anyone involved in TV reception around Australia.

The review copy came from publisher ABD, which can supply it directly by mail for the price quoted. Their address is PO Box 294, Kippax ACT 2615. (J.R.) ♦

Home theatre guide...

BUILD YOUR OWN HOME THEATER, by Robert Wolenik. Published by Butterworth Heinemann, 1997. Soft cover, 187 x 230mm, 200 pages. ISBN 0-7506-9942-6. RRP \$35.

These days most hifi shops specialise in sound and vision, under the banner of home theatre. It's a growth industry, so books on the subject are typically aimed at a public unfamiliar with terms like THX and AC-3, and who are also scared off by the expense. This book is relatively non-technical, and like others on the subject, seeks to educate the reader so purchasing decisions can be made with some knowledge. Unfortunately, the prices given are for the US market, where it appears you can buy a complete home theatre system (basic, but including all speakers, surround amp and a stereo 25" TV set) for around \$1500.

The book is very comprehensive, and relatively up-to-date. It makes the point that understanding what's available in the market can help you save money, and then goes on to cover virtually every aspect of home theatre equipment. It also discusses the home theatre room, along with methods of insulating it so the sound level outside the room doesn't annoy the neighbours. Included are a number of colour photos of various home theatre installations, which range from affordable to millionaire material.

Equipment discussed includes speakers, TV sets, surround amplifiers, VCRs, videodisc



players (but not DVD) and so on. It also covers equipment you might not think of as home theatre, such as video games, video cameras, cable TV (including satellite) and switching boxes that let you select the device you want to watch or listen to. The author is the editor of various US magazines about home entertainment, and is described as 'an avid fan of all types of consumer electronics, and who is perpetually upgrading his own home theatre'.

It has lots of other useful information, such as installation, lighting and furnishing. And because the US seems to be around two years ahead of Australia in consumer electronics, most Aussie readers will find something in the book they didn't know.

The review copy came directly from Butterworth Heinemann, PO Box 146, Port Melbourne 3207. (P.P.)

Electronics Australia is one of the longest-running technical magazines in the world. We started as **Wireless Weekly** in August 1922 and became **Radio and Hobbies in Australia** in April 1939. The title was changed to **Radio, Television and Hobbies** in February 1955 and finally, to **Electronics Australia** in April 1965. Here are some interesting items from past issues:

50 years ago

November 1948

The Germanium Crystal Amplifier: All current American magazines are featuring the Transistor or crystal triode, developed by engineers of the Bell Telephone Laboratories. A product of pure physical research, this tiny unit, still in experimental form, may prove to be as significant, in radio development, as the early products of Fleming and De Forest.

In its present experimental form the transistor is a metal cylinder 3/16 inch in diameter and 5/8 inch long. Inside the cylinder is a block of germanium soldered to a metal disc to which it makes low resistance contact, and that grounds it to the cylinder. Two 2-mil tungsten wires make contact with the upper face of the germanium, at points about 0.002 inch apart.

An input signal, in series with a small positive bias voltage, is applied between the grounded face and the input 'cat's whisker' (emitter). A larger negative bias voltage is applied between ground and the output (collector) point contact. The output signal appears across a load resistor in series with the negative bias. In this manner a power gain of 100 (20dB) is obtained between input and output of the transistor.

25 years ago

November 1973

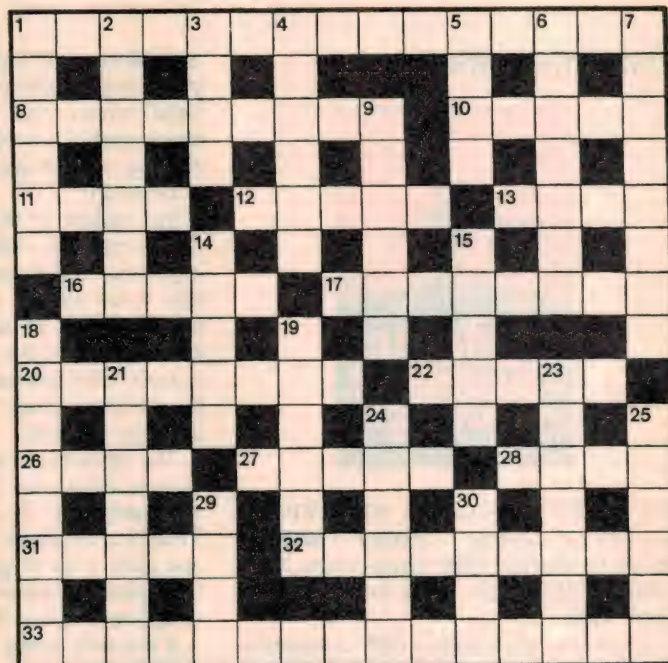
Philips shows VLP Player: Advanced models of the Philips VLP home video disc player were demonstrated at this year's International Radio and Television Exhibition in Berlin. The company also gave further technical details about the VLP system, which seems destined for a major role in the home video field.

The VLP system combines a pulse-code recording technique with a 1500 rpm disc speed, to obtain the required signal density for video and audio playback. It is thus similar to the approach taken by Teldec, except that the VLP system has no contact between the pickup mechanism and the disc. Instead the readout is optical, using light from a low power helium-neon laser.

The VLP record, like a conventional vinyl LP, is 30cm in diameter and is manufactured by a similar pressing operation. It consists of a transparent polyvinyl material which is coated on one side with a very thin reflecting metal layer. The transparent material protects the information track from contamination, so that handling of the record is easy.

The track on the VLP record consists of a sequence of microscopic oblong pits. All the pits are equal in depth and width (0.16µm and 0.8µm respectively), with a track pitch of only 2.0µm (centre-to-centre of adjacent tracks). ♦

Crossword



Across

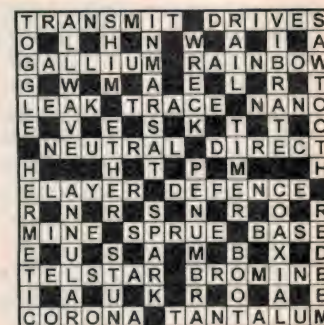
- 1 Parallel combination that impedes certain unwanted signals. (8,7)
- 8 Prominent brand of electronic diagnostic instruments. (9)
- 10 Makes a recording. (5)
- 11 Crystal used in laser. (4)
- 12 Time shift in an electronic signal. (5)
- 13 Gas-tight glass envelope. (4)
- 16 Microsoft spreadsheet program. (5)
- 17 Changed direction. (8)
- 20 Amount of light falling on photographic film. (8)
- 22 Computer and motoring term implying more speed. (5)
- 26 Symbol used in charge designation. (4)
- 27 Weather satellite. (5)
- 28 Prefix indicating 1000. (4)
- 31 Maximum spread of a set of readings. (5)
- 32 Object in orbit. (9)
- 33 Who discovered Uranus in 1781? (7,8)

Down

- 1 Spinning components. (6)
- 2 Coin-operated record playing system. (7)
- 3 Item conveying instructions, etc, to 1960s computer. (4)
- 4 Imperial units of mass. (6)

- 5 Cost basis for telephone use. (4)
- 6 Removes from socket. (7)
- 7 Places where equipment is evaluated. (8)
- 9 Made radiograph. (1-5)
- 14 Detect presence of. (5)
- 15 Remove faults. (5)
- 18 Item holding two machine parts together. (8)
- 19 Paths of moons. (6)
- 21 Pertaining to pages. (7)
- 23 Nationality of 25 down. (7)
- 24 Magnetic structure for plasma containment. (6)
- 25 Sir Bernard, notable radio astronomer. (6)
- 29 Prefix often seen with conductor. (4)
- 30 Positive. (4) ♦

October's solution:



Electronics Australia's **Professional Electronics**

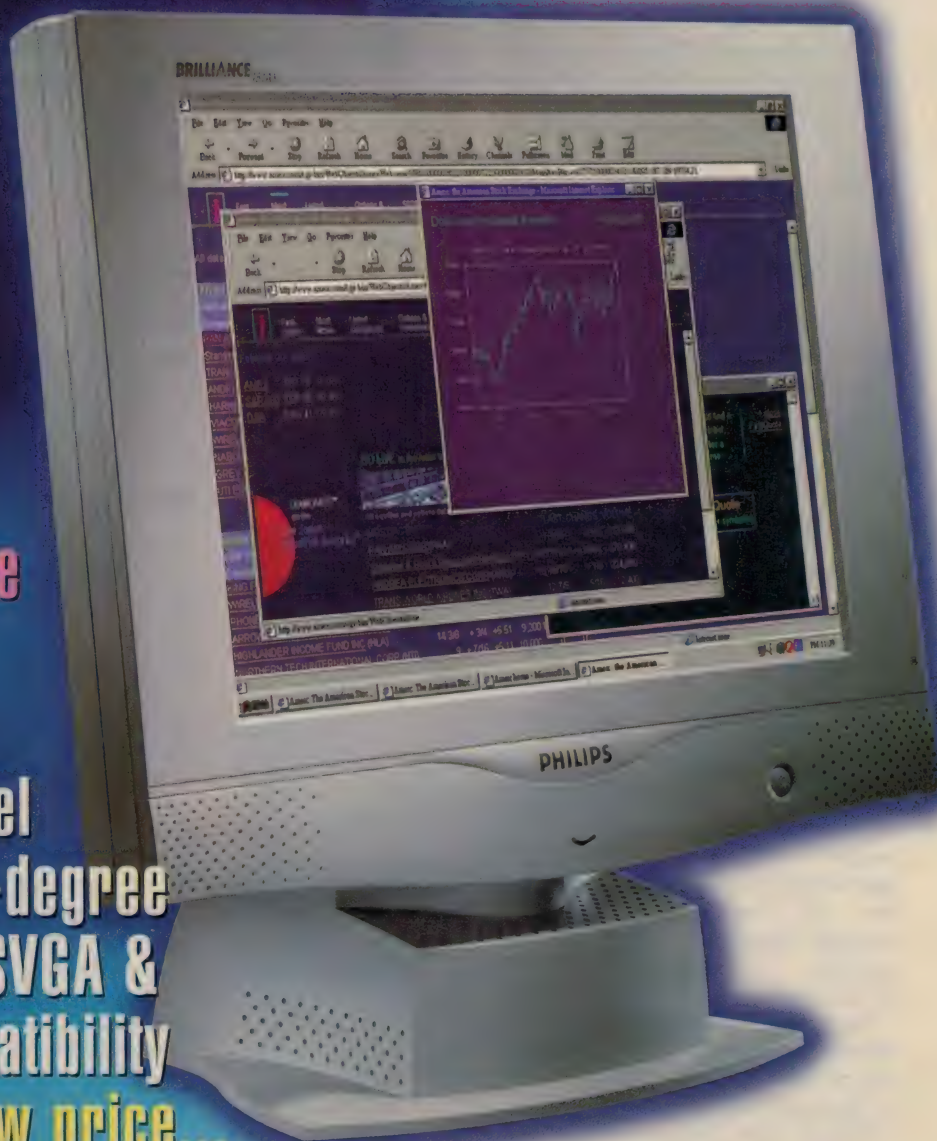
**Texas Instruments announces
transistors with 0.07um
design rules, expects to have
chips in production by 2001**

**New postage-stamp sized
HDD from IBM stores 340MB**

**Review: Digital Electronics
CD-ROM from Matrix MM**

**Feature on Queensland's
Electronics Industry**

**Philips' new
151AX Brilliance
LCD monitor:
15.1" image,
1024 x 768 pixel
resolution, 160-degree
viewing angle, SVGA &
Macintosh compatibility
— at a new low price...**



Highlights News

Belden moves regional HQ to Melbourne

BELDEN WIRE & CABLE Company, which purchased the Communications Division of Olex Cables in March this year from Pacific Dunlop, has moved its regional head office from Singapore to Melbourne.

US based and publicly listed in 1993, Belden is one of the world's largest designers, manufacturers and marketers of telecommunications wire and cable products. It services the industrial, broadcast, computer and manufacturing markets. The company's Asia Pacific office is now located at the company's wire cable and optical fibre cable manufacturing facilities at Tottenham.

Mr John Valentine, Belden's newly appointed MD Asia Pacific, said the company has formed a beachhead in Melbourne for the Asia Pacific region and will develop policies and procedures that suit this part of the world.

"The acquisition of Olex's Communications Division has not only provided us with two high tech manufacturing operations, but also an exceptional team of highly qualified staff with enormous skills and abilities", Mr Valentine said.

Part of a worldwide decentralisation plan by Belden, the Melbourne plant has already commenced manufacturing Belden

products. The Belden product line, which numbers approximately 17,000 items, complements the Olex product range and although there will be an amalgamation of some products, customers are assured that virtually all Olex and Belden products will continue to be produced.

Victorian Industry Minister Mark Birrell welcomed the move by Belden. "Far sighted companies like Belden recognise the time is right to establish their Asia-Pacific headquarters in the most stable centre in the region. Belden is a welcome new investor in Australia", said Mr Birrell.



New Melbourne HQ for Siemens

IN A MODERN RE-ENACTMENT of a medieval ceremony, a tree was placed at the highest point of Siemens' new headquarters for Australia and New Zealand, during its construction in Bayswater, an outer-eastern suburb of Melbourne. For the ceremony, blending German tradition with the Australian environment, an Australian gum tree was chosen, but decorated in the European fashion.

Speaking on behalf of the owner, Siemens' Chairman and MD Mr Helmut Pekarek said "Our business strategy is profitable growth and increased Economic Value Added. We want to win market share, by among other things, increasing our competitiveness. Through significant investment in this site, we expect tangible increases in productivity, when we are all working together here in a modern, efficient environment".

Councillor Tom Blaze, Mayor of the City of Knox, officially 'launched' the tree at ground level, from



where it was whisked by an overhead crane to its lofty perch. In welcoming this major new investment to the city, he said "It brings employment and we all benefit. Congratulations on coming to Bayswater. It is good for us. We'll do our best to be good for you."

The new buildings are expected to be ready for next Christmas, when Siemens' present activities in Church Street, Richmond will be relocated to Bayswater.

Embedded systems pose major Y2K problem

ACCORDING TO INDUSTRY experts, embedded systems are likely to pose the greatest Year 2000 threat, simply because they aren't taken seriously and there is a lack of understanding and awareness. To date much attention has been focused on computer mainframes, hardware and software with action on embedded systems generally low.

Embedded systems are systems which contain computer chips (i.e., microcontrollers) and source code literally 'embedded' within machinery and equipment (often in ROMs). They provide the intelligence associated with process control systems and have 'built-in' computer logic.

Examples of these embedded systems range from building management such as security and fire systems to manufacturing equipment, traffic and control systems.

A recent survey reported in *The Australian* reported that just 21% of companies had undertaken a full audit of their exposure to embedded system-related problems. This compares with 42% for business systems generally.

The effect of the failure of embedded systems may well cause many problems. According to Tim Murray, Managing Director of Infrastructure Control Services, we simply don't know how many embedded control systems will be affected and what 'affected' actually means.

Another issue Murray explains with embedded systems is the lack of responsibility taken by the engineering profession who designed,

built, commissioned and maintained these embedded control systems. They believe the Year 2000 is an IT issue, whereas many IT consultants don't understand embedded systems and believe it belongs to engineering. This then results in a lack of ownership of the problem.

Some industry analysts have estimated that the number of embedded systems that will misbehave due to the date change may be as little as 5%. Yet Murray explains, if an organisation has 1000 embedded systems (probably about average for a manufacturing company), just one system that is not year 2000 ready could seriously affect the business as machines are often reliant upon each other.

"A key problem with embedded systems is that they fall outside the traditional responsibility of IT managers and so have not received the attention they require. The emphasis on embedded systems has been far more recent, and so the amount of work being done has not been great", said Graeme Inchley, CEO of the Year2k Industry Program.

Acer wins Treasury tender

ACER COMPUTER Australia has won a highly competitive tender to supply The Commonwealth Treasury with desktop personal computers. The AcerPower PCs, with 266MHz Intel Pentium processors at the entry level, were selected after an exhaustive tendering process, winning on the basis of total cost of ownership and price/performance benefits.

"We evaluated the PCs on their performance using a suite of our own applications and matched that up on a price/efficiency frontier which gave us an efficiency value versus value for money. Acer was clearly in front for us, so we selected them on that basis", said Trevor Webeck, chief information officer (CIO) at the Commonwealth Treasury of Australia.

"People were running economic models that were taking them up to 15 minutes to recalculate", said Mr Webeck. "In some instances we're seeing that 15 minutes reduced to three minutes. They can now do a number of recalculations in an hour, where it would have taken them two or three hours to do the same work."

Canberra based Acer reseller Dataflex, a specialist in delivering solutions to the Federal Government, worked with Acer on the site roll-out, completed by the end of August.

"We installed three hundred PCs in ten days," said Mr Webeck.

SAFT doubles Aust. battery production

SAFT AUSTRALIA, part of the international Alcatel Group and Australia's only manufacturer of nickel-cadmium batteries, has commenced a major upgrading of its facility in western Sydney which will see production capacity there doubled.

SAFT batteries were used by the recent Mars Explorer vehicle, while in Australia batteries are used in this country's latest submarines and frigates as well as industrial, commercial and computer

electronics applications demanding high performance and reliability.

Mr Richard Jensen MD of SAFT Australia said the new production capacity and a new corporate identity would come into effect progressively throughout the

second half of this year. Operating under the new name SAFT Australia, the company has embarked on a \$1 million investment and upgrade programme.

"Changes will reflect the company's outstanding growth over the recent years and introduce additional capacity for rapid response to ongoing customer needs", said Mr Jensen. "Because our Sydney manufacturing facility has a 3.5-million-amp production output and outstanding quality standards, the parent company could see no reason to import into Australia. That is what our competitors are doing."

"The advantages of being the sole Australian based manufacturer of nickel-cadmium batteries is that we can design and build to customer specifications and quickly fill their orders. Such orders would be impractical if the customer had to wait on batteries shipped from the other side of the world."

Recent projects include backup power for the Victorian Arts Centre, the Sydney Light Rail system and battery equipment for the National Rail Corporation's latest 4000hp locomotives.

Free catalog on digital audio gear

MELBOURNE BASED digital music specialist Moore Music has just released a new 40-page full-colour catalog providing information on the wide range of digital audio hardware and software distributed by the firm. It also provides basic information on digital recording and MIDI-based music systems.

Products distributed and available from Moore Music include the high-quality Terratec range of digital audio cards for PCs, the SEK'D range of

Prodif cards and outboard D/A-A/D converters, the Frontier Design Group range of digital audio systems and the Motu Audio 2408 digital recording system. The software range includes PowerTracks Pro Audio, Digital Orchestrator Pro, Cakewalk ProAudio 7, SEK'D Samplitude Studio, ACID, Sonic Foundry's Sound Forge 4.0D and XP and CD Architect, and Sound Engine.

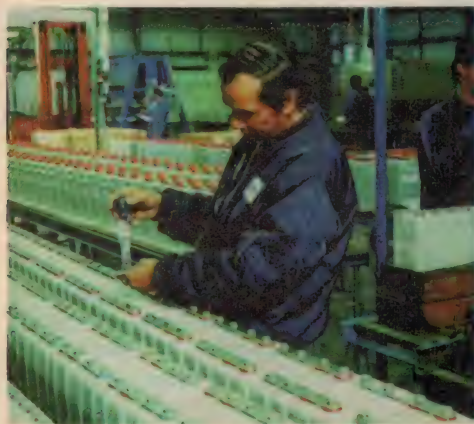
The catalog normally sells for \$5 per copy, but Moore Music is offering it to interested *Electronics Australia* readers free on application. Their address is 219 Napier Street, Fitzroy 3065 (PO Box 2735, Fitzroy MDC 3065).



Vale Sir Alan Walsh

ONE OF AUSTRALIA'S most famous and talented scientists, Sir Alan Walsh, has died at the age of 81. Sir Alan worked in the CSIRO's Division of Industrial Chemistry for many years, and in the 1950s invented two spectroscopic analysis technologies for which he became world renowned: the multiple monochromator (1950) and the atomic absorption spectrometer (1952). The latter was patented by the CSIRO and licensed by firms both here and overseas.

The atomic absorption spectrometer has become an invaluable tool for fast and accurate chemical analysis.



Refurbished T&M gear posted on Web

FIRMS AND INDIVIDUALS on limited budgets will not doubt be interested to learn that Hewlett-Packard is now listing end-of-production equipment and refurbished test and measurement equipment on the world wide web, at www.hp.com/go/refurbished.

The refurbished equipment, which can be ordered by phone, comes with a one-year limited warranty, covering all the components covered by HP warranties on new products.

In addition to refurbished products, the web site lists promotions, special trade-in programs and sales. For more information, contact HP Australia's T&M Call Centre on 1800 629 485.

New Aust. laminar flow control system

SOUTH AUSTRALIAN firm Clyde-Apac believes its release of a state-of-the-art electronic control system will further strengthen its reputation as Australia's leading manufacturer of laminar flow equipment. The first in Australia to offer on-line monitoring and diagnostic capability via modem, the new system provides cabinet users with enhanced functionality and cabinet performance.



The new system — which took almost two years to develop and test — provides cabinet users with greater cabinet safety and reliability. This is particularly important when working in an environment where hazardous biological agents are handled.

While Clyde-Apac's cabinets have used a microprocessor-controlled monitoring and diagnostic system since 1994, the new system is claimed to represent a huge step forward. The new generation controller has been designed for the company's 2000 Series range, including Class I and Class II biological safety cabinets and Cytogard cytotoxic drug safety cabinets.

Fully-programmable, the new system uses purpose-developed software. Air flows, pressure-switch settings, next-service date and other service-mode functions can be adjusted using a palmtop PC which uses pull-down menus, factory defaults or previous settings to adjust any of the stored parameters. The controller contains all new circuitry, along with an adjustable automatic switch-off timer for UV lamps, a timer for

experiments and a real-time clock. Improved diagnostics ensure that the cabinet's settings are more precise, providing improved data on cabinet performance.

Clyde-Apac's Product Engineer Tom Merrigan said the system also provided an interface with building energy management systems, proving invaluable in large institutions where vital safety equipment must be continuously monitored.

The on-line service access, a first for the Australian market, will be of particular interest to the company's overseas customers. Clyde-Apac exports a significant number of the cabinets it produces.

W&G/Wavetek merger finalised

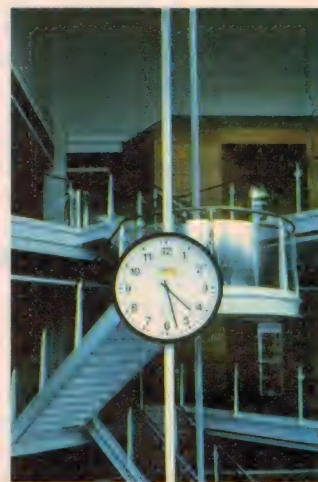
GERMANY'S WANDEL & Goltermann Management Holding GmbH and US firm Wavetek Corporation have jointly announced that definitive agreements have been signed for the merger of the two companies that was announced in March. This merger will create the world's second largest communications test company, with annual revenues in excess of \$400 million (700 million DM).

The merger is conditional upon regulatory approval and certain additional conditions, but was expected to be completed before the end of the year.

"This definitive agreement brings us one step further toward providing the broad portfolio of products and worldwide services our customers demand", said Peter Wagner, President and CEO of Wandel & Goltermann and designated President and CEO of the combined company. "Positive response to our merger announcement from our employees and our customers makes us confident of our success in the marketplace and in the integration of our two companies."

Melbourne organisations adopt HPM's TeleChron

HPM TECHNOLOGY has announced that a number of Melbourne-based businesses, government institutions, radio and television stations, universities and the airport have adopted its new TeleChron system for distributing synchronised time. Recently launched in Australia, TeleChron technology represents a significant step forward in advanced time management. Clocks in the TeleChron network are updated to accurate time by a paged signal delivered Australia wide. The system was conceived and developed by Melbourne based HPM Technologies.



Geoff Glover, Property Facilities Manager of ABC Victoria, explained that "The TeleChron clock was demonstrated to ABC staff,

IN BRIEF

- Sydney-based mobile communications specialist **Mastercom** has celebrated 30 years of service to the local communications industry. The firm held a one-day trade fair in September at the Royal Park Hotel in Parramatta, where it also unveiled its web site (at www.mastercom.com.au).
- South Australian loudspeaker system manufacturer **Sonique Audio** has

moved its factory, to 86 Rundle Road, Salisbury South 5106; phone (08) 8285 9722. The mail address is PO Box 201, Salisbury South 5106.

- Mr Nigel Peck, founder and chairman of **NHP Electrical Engineering Products**, has announced the appointment of three new directors to NHP's board: Lloyd Thomas, Russell Turner and Angelo Torresan. Mr Thomas is a

member of the NHP Holdings board, while Messrs Turner and Torresan were previously associate directors of NHP Electrical Engineering Products.

- **Lighting 98 — Techniques & Technology**, the international lighting convention and trade exhibition, will be held at the Carlton Crest Hotel in Brisbane, on 9 - 11 November 1998. ♦

and the features were so attractive that a number were purchased for closer evaluation. As an organisation dependent on timing, we couldn't ignore an opportunity to sample a world first in terms of accuracy and maintenance-free operation."

Melbourne Airport is the world's first airport to install TeleChron time. Airport authorities have purchased 27 clocks, and plan to install them in departure and arrival lounges for the convenience of both business travellers and tourists. The smooth operation of Melbourne Airport, like the ABC, is dependent on time.

The TeleChron clock offers access to global time. Its specialised paging system ensures accurate time for seven Australian capital cities and eight international time zones, without ever having to update.

A number of Melbourne's universities, businesses and number of health and educational facilities have also installed the system.

Schlumberger helps China roll out smart cards

GLOBAL CONGLOMERATE and smart card specialist Schlumberger has been selected by the People's Bank of China (PBOC) to provide training and equipment to establish the Certification Centre for China's new nation-wide smart payment card project. The Centre will be responsible for testing and certifying the cards and terminals supplied by vendors to the scheme, which will provide debit and electronic purse facilities in China.

The new Certification Centre will ensure interoperability and speed the roll-out of the biggest smart bank card scheme in the world. Four international smart card companies and several Chinese suppliers are already involved in the project, and prototype cards and terminals have begun to be released.

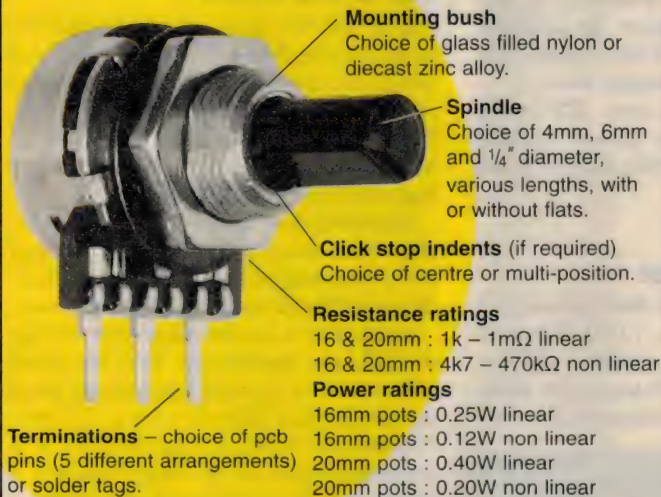
PBOC requested technical assistance to set up the Certification



Centre, and selected Schlumberger as its consulting partner following presentations by all four of the international smart card companies. The key factors behind the bank's decision were the broad-ranging experience of Schlumberger in this field — which spans smart cards and terminals — and the company's detailed knowledge of the PBOC specification following its recent release of the first complete smart card solution (the Qianflex product range) meeting the specification of China's new smart payment card project. PBOC also appreciated the track record of Schlumberger in this specialised work, which included providing equipment to a similar certification centre for VISA in the USA.

The new Certification Centre will be operated for the PBOC by the China Banking Card Switching Centre in Beijing. Equipment and training will be provided via the Schlumberger office in Beijing, and the company's smart card design and manufacturing centre in Hong Kong. ♦

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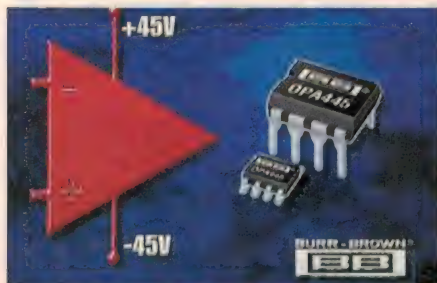
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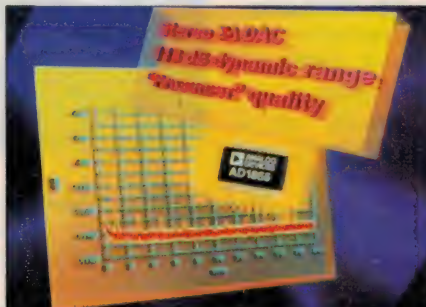
First 90V op-amp in SO-8 SMT package

Unlike many power op-amps, the OPA445



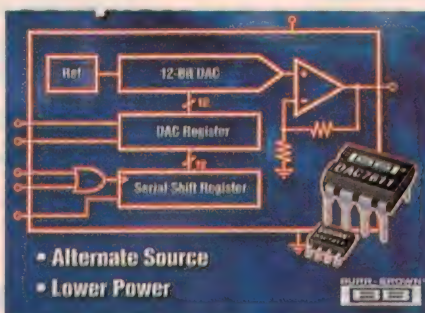
Audio DAC has 113dB dynamic range

The AD1855 achieves 113dB dynamic range and signal-to-noise ratio (not muted) at



For more information circle 272 on the reader service card or contact Analog Devices, Suite 4/1621 Point Nepean Road, West Rosebud 3940.

The new DAC7611 from **Burr-Brown** is a serial input, low power, 12-bit digital-to-analog converter (DAC) complete with reference — all in a small 8-lead SOIC package. Designed using the company's low volt-



For more information circle **273** on the reader service card or contact distributor Kenelec, 2 Apollo Court, Blackburn 3130.

In battery powered systems in particular, where the available bias voltage is limited, the high ratio hyperabrupt tuner diode provides a solution. The ZMV900 series demonstrates a much faster change in capacitance for a given change in bias voltage. For

example the mid range ZMV933 device provides a capacitance of 42pF at a V_r of 1V, falling to 12pF at 4V. Breakdown voltage for this product range is 12V.

For more information circle 274 on the reader service card or contact GEC Electronics Division, Unit 1, 38 South Street, Rydalmere 2116.

RF detector chip operates to 2.5GHz

For RF and communications systems designers who work with high dynamic range requirements in their transmit and receive circuits, **Analog Devices** has developed the AD8313 2.5GHz RF detector. This device directly converts high-frequency modulated RF-signal envelopes into accurate, temperature-stable DC signals.

Offering 65dB dynamic range and ± 1 dB accuracy, the ADS313 is claimed as the first of its kind to operate up to 2.5GHz. The RF envelope of the input waveform, typically a



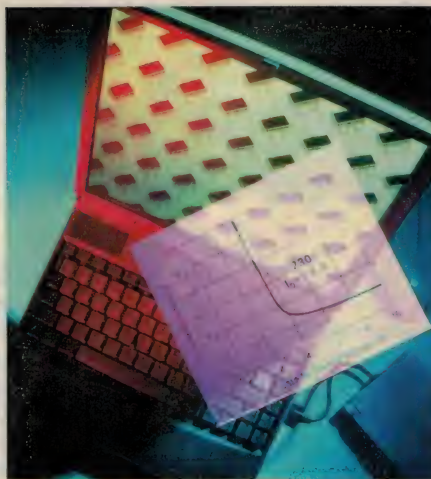
modulated signal, is detected and amplified in a linear approximation to the logarithmic function. The output is a DC signal representing the logarithm of the input signal envelope. Since this log amp is detecting (rectifying) in nature, it eliminates the need for downconversion. This saves designers several components, as well as cost and space.

The AD8313 is well suited for any HF-UHF transmitter measurement and control applications such as wireless local loop, base stations and radio links, communications instrumentation, communications test equipment, broadcast TV or radio, avionics, CATV headend, satellite and military. Unlike discrete and hybridized alternatives, the AD8313 is monolithic, accurate, small and low cost.

For more information circle 275 on the reader service card or contact Analog Devices, Suite 4/1621 Point Nepean Road, West Rosebud 3940.

SOT-23 power MOSFETs dissipate 1.5W

The new Si2304DS (N-channel) and Si2303DS (P-channel) from **Siliconix** can handle up to 2.5A of current and can be used to replace SO-8 or TSSOP-8 devices for load switching and power switching in notebook computers, cell phones, and bar code scanners. In notebooks, they are particularly suit-



ed for cell balancing in a lithium ion battery, where a MOSFET is used to discharge one of the cells slightly to make sure that all the cells reach full charge at the same time.

Providing a full 30V breakdown voltage, the new devices can both dissipate 1.5W of power, despite their small package size. On-resistance is 117m Ω for the N-channel Si2304DS and 240m Ω for the P-channel Si2303DS, both at a 10V gate drive.

For more information circle 276 on the reader service card or contact distributors Braemac or Avnet-VSI Electronics.

Dual micro-C LDOs in SOT-23 package

Micrel Semiconductor has announced a new dual 50mA low power, low-dropout (LDO) regulator, the MIC5211, in a new 6-pin version of Micrel's 'IttyBitty' SOT-23 package. This will allow designers to get a dual LDO in the same footprint that has traditionally been required for a single LDO.

The MIC5211 is a 'micro-cap' low dropout regulator, indicating that it is stable using small, low-cost ceramic output capacitors — further enhancing its size advantage. It is well suited to mobile applications where small size is critical. Low-dropout voltage of 250mV at 50mA, low quiescent current of 180uA and a shutdown pin combine to extend battery life. In shutdown, the devices have a near-zero supply current of 0.01uA. Separate enable input pins allow independent control of the individual regulators.

The MIC5211 is also capable of withstanding 20V at its input, critical in many applica-



tions since low cost chargers often emit power supply spikes which would be fatal for many other low power LDO regulators. Additionally, the MIC5211 features current limit, thermal shutdown and reverse battery protection.

For more information circle 277 on the reader service card or contact GEC Electronics Division, Unit 1, 38 South Street, Rydalmere 2116.

12 bit 500kHz ADC in MSOP form

Burr-Brown's new ADS7834 is a 12-bit sampling analog-to-digital converter (ADC) packaged in a small 8-pin MSOP. It features a 500kHz sampling rate, 11mW power dissipation and an analog input range of zero to the reference voltage for greater effective resolution.

Low power, small size and high speed make the ADS7834 well suited for high-speed applications where board space and power are at a premium, such as high-speed data acquisition, digital signal processing, battery operated systems, spectrum analysis and portable instruments.

The ADS7834 comes complete with sample/hold, internal 2.5V reference, single +5V supply operation and synchronous serial interface (serial interface provides low-cost isolation for remote data acquisition). The device can be placed in a power-down mode that reduces power dissipation to just 2.5mW. The internal reference can be overdriven by an external voltage.

The ADS7834 outperforms the LTC1400 with a higher sampling rate (500kHz vs 400kHz), lower power dissipation (11mW vs 160mW) and a smaller package (MSOP vs SOIC).

For more information circle 278 on the reader service card or contact Kenelec, 2 Apollo Court, Blackburn 3130. ♦

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New Products

Temp controlled soldering station

Jaycar Electronics has released the new Duratech Solder Station, to compliment their already extensive range of soldering stations and soldering equipment. The 60W station has an adjustable temperature range of 150-450°C $\pm 3^\circ\text{C}$, which makes it suitable for a wide variety of tasks. The temperature dial can even be locked in place, using the Allen key supplied.

Main feature of the station is the soldering tool itself, a lightweight soldering pencil fitted with a silicone rubber cord which is extremely flexible — giving close to cordless operation. The heater is a state of the art ceramic element with professional grade PTC thermistor/sensor feedback.

The station case is robustly constructed and includes a stainless steel tray for storing the spare tips. (Seven tips are supplied.) The station sells for \$189 and comes with a 12-month warranty.

For more details on the Duratech Soldering Station (TS-1380), circle 245 on the reader service card, visit any Jaycar store or contact Jaycar Electronics, 8-10 Leeds St., Rhodes 2138.



New Pulse/Data generators from HP



Hewlett-Packard has introduced the HP 81100 family of pulse/data generators, intended for design and test engineers primarily in the semiconductor, computer and communications industries.

The HP 81100 family, with performance levels from 80MHz to 330MHz, and with levels of 50MHz and 660MHz expected to be added later this year, generates one- or two-channel digital waveforms necessary to test today's digital designs. Four models are available, each with a different frequency range. For less demanding applications, such as creating a signal for testing a radar station, the HP 81100 family is said to provide a solution at half the cost of former HP pulse/data generators.

The new generators also meet the demands of more complex digital tests, such as IC verification or clock testing of microprocessors, which require precise timing and a frequency of 500MHz.

The HP 81100 family provide all standard pulses, digital patterns, sequenced and looped data and multilevel waveforms required for testing the digital and analog functionality of designs. Glitch-free

change of timing — for example, phased locked loop (PLL) tests — enables the user to perform a greater range of measurements more easily. Fixed delay between trigger in and signal out allows timing synchronization within a test setup of different instruments. All models feature the same operation for functions, which the user can program through the HP-IB or front panel. Based on the familiar HP 8110A, the user interface is easy to use and features a graphical display showing all the parameters at a glance.

For more information, circle 241 on the reader service card or contact HP's Test and Measurement Call Centre on 1800 629 485.

PC-based EMI receivers

The new AFJ model ER55 EMI receivers are a range of modular, upgradable receivers covering the frequency range from 9kHz to 1GHz, and are suitable for full compliance and pre-compliance tests (via the 'Spectrum Analyser Mode', offering a very fast scan rate).

The receivers are equipped with Quasi-Peak Detectors, and can have up to 10 fixed and tuned preselector filters providing more than 40dB attenuation for intermediate frequency, image frequency and intermodulation effects. Optional features include short and long click counting, as well as continuous interference observation via tuning to CISPR-required frequencies.

The ER55 receivers are PC-based, and are controlled by Windows software that enable the operator to set up parameters as specified by CISPR 16, or according to individual requirements. The program allows the setting of frequency range, frequency step, selection of detectors (Peak, Quasi-Peak, and Average), and antenna correction factors. Customised software for communication with controllers of slide-bars, turntables, and antenna masts is also available.

A wide range of accessories includes LISNs; bi-conic, log-periodic and broadband antennas; loop antennas and near field probes; and passive probes and absorbing clamps.

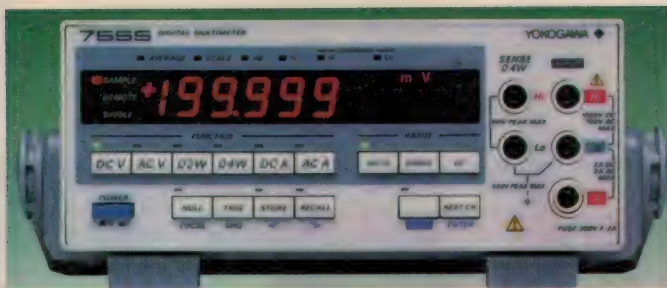
For more information circle 242 on the reader service card or contact Westek Industrial Products, Unit 2, 6-10 Maria Street, Laverton North 3026.

5-1/2 digit bench DMM with memory

Yokogawa's 7555 digital multimeter is a versatile, compact unit designed for ease of use with high performance. The unit's front panel has been set out for easy operability, with enlarged keys that are few in number. Frequently used setups can be stored in the multimeter and recalled quickly.

Featuring a large, easy to read 5-1/2 digit display and a high sampling rate, the 7555 measures DC volts and amps, AC volts and amps RMS, plus two- and four-wire resistance measurement. Currents up to 200A can be measured using the optionally available AC/DC current clamp. Basic accuracy is 0.055% ± 6 digits





(24hr). The memory function incorporated into the 7555 can store up to 2000 measurement items and up to 10 setups.

Full communications functions include RS-232C as standard with GB-IB offered as an option. A BCD parallel output with measurement data, decimal point, units, polarity and over-range information is also optionally available, as is a D/A output of +1 to -1V DC. Also available is an 8-channel scanner for DC volts input.

For more information circle 243 on the reader service card or contact Yokogawa Australia, 25-27 Paul Street North, North Ryde 2113.

Free CD-ROM gives T&M encyclopedia

National Instruments has produced an updated version of its free CD-ROM encyclopedia for instrumentation. Instrupedia 98, a source of abundant information useful to engineers and scientists when building PC-based test, measurement, and industrial automation applications, includes the entire 1998 National Instruments product catalog, evaluation software, and a variety of example programs. In addition, Instrupedia contains tutorials covering instrumentation software, GPIB, VXI, motion control, serial, data acquisition (DAQ) hardware, and more.

The updated Instrupedia features an enhanced user interface for faster navigation and also boasts a new intuitive search engine. Compatible with Windows 9.5/3.1 and Macintosh/Power Macintosh systems, Instrupedia 98 also provides links directly to the National Instruments Instrumentation Web.

Instrupedia 98 is available now free of charge. For more information, circle 244 on the reader service card or contact National Instruments Australia, PO Box 466, Ringwood 3134.

Linear supply features low noise

The new fully linear **Thurby** Thandar PL-P series power supplies are programmable, and supplied as standard with both RS-232 and GPIB interfaces. The RS-232 interface can be operated in ARC (Addressable RS232 Chain) mode, permitting multiple instrument control from a PC.

The power supplies are available as single, dual and triple output versions, with the latter version featuring a high current logic 'third' output variable between 4V and 7V and at currents to 7A.

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For more information circle 245 on the reader service card or contact Nilsen Technologies, 150 Oxford Street, Collingwood 3066. ♦



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HP's new Infinium family of oscilloscopes employ leading-edge technology to achieve outstanding levels of performance, combined with intuitive ease of use. They provide the very latest digital sampling, signal processing and display technology, together with an internal PC with customised Windows 95 graphical user interface. This allows you to not only set up the scope faster and more confidently than ever before, but also to save and recall both setups and measured waveforms — and also transfer them to your PC, for use in documents and reports. The inbuilt Windows GUI is mouse-driven and very intuitive, and even includes a full on-line, context sensitive help system — so there's no need for the traditional weighty user manual!

CONDITIONS OF ENTRY:

1. The competition is open to Australian residents authorising a new or renewed subscription to Electronics Australia magazine. Employees of IPMG, Hewlett Packard, their subsidiaries and families are not eligible to enter. 2. Prizes are not transferable or exchangeable and may not be converted to cash. 3. The judge's decision is final and no correspondence will be entered into. 4. The competition commences on October 12, 1998 and closes last mail on February 23, 1999. 5. The draw is at the promoter's premises on March 2, 1999 at 11 am and the winner will be announced in The Australian, issue date March 4, 1999, and notified by mail. In the event of any unclaimed or unwanted prize, a second chance draw will be conducted on June 23, 1999, subject of Reg. 37 of the Lottery & Gaming Regulations 1993 (SA). 6. The prize is a Hewlett Packard Oscilloscope valued at \$20,813 rrp. 7. Total prize value \$20,813 rrp. 8. The promoter is FPC Magazines, 180 Bourke Road, Alexandria, NSW 2015. 9. All entries become the property of FPC Magazines, and may be used for future marketing purposes.
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Photo shows four-channel model — prize is two-channel model

The PC inside Infinium oscilloscopes is based on an AMD K6 processor running at 200MHz and with 512KB of L2 cache, which allows waveforms to be updated at more than 1750 waveforms/second. It provides a waveform annotation feature (great for documentation), and along with standard I/O ports it even includes a 10Mb/s Ethernet port for LAN connectivity.

The HP 54810A Infinium Oscilloscope offers two vertical input channels, with a top sampling rate of 1GS/s and a maximum bandwidth of 500MHz, with 32K of memory depth per channel. It also offers an easy-to-drive 'analog like' front panel, plus a big and bright high-res LCD colour display screen. The controls are even colour coded to the channel traces, to minimise confusion. Setups can be easily saved and recalled from floppy disk, and the mouse-driven Windows GUI allow very intuitive 'drag and drop' operation for carrying out measurements.

In short, it's a truly superb instrument that would be a great asset to any home or professional lab — and it could be YOURS, if you're the lucky winner of our subscriptions draw!

Griffith's IAP goes from strength to strength

Griffith University's innovative Industrial Affiliates Program has just completed another extremely successful year, with no less than 42 final-year undergraduate students working on design and development projects with both private firms and public-owned organisations. This brings to over 200 the total number of industry projects completed under the program since 1993.

NOW IN ITS SEVENTH successful year, Griffith University's Industrial Affiliates Program enables students to use the extensive electronics resources of the University to work on important applied projects in a 'real life' situation with an industrial partner. The Program therefore has a dual benefit: the student gains valuable practical experience, while also assisting in the development of high technology 'intelligent' electronics for Queensland industries.

Industrial partners in the program gain an undergraduate who is committed to succeed. The student is with the industrial partner for four days a week, for a minimum of three months from late February to early June. The end result of the student's time in the Industrial Affiliates Program is a student with a broad understanding of the processes involved in industry activities. Industry itself gains the benefit of the student's research and design outputs.

In previous years, the IAP projects have been undertaken by final-year students working for the Bachelor of Engineering in Microelectronic Engineering. For the first time, the 1998 group of students included students in their fifth year of a combined degree in Microelectronic Engineering and Information Technology.

Here are some of the latest crop of IAP success stories:

Cleaner mobile comms

THAT OFTEN-HEARD mobile phone phrase "You're breaking up!" could become less common, as a result of the new technol-



IAP students Melanie Butt (L) and Neil Davey (centre) with supervisor James Mansfield. Melanie and Neil worked in conjunction with Labrador healthcare product manufacturer MicroMedical Industries.

ogy developed by IAP student Dean Bradford, who spent 14 weeks with telecommunications company Filtronic Comtek to develop a filter which will improve mobile phone signals.

"It basically separates unwanted signals

from the wanted ones, while offering a significant improvement in the signal loss of conventional filters at mobile phone base stations", said Dean, a resident of Sheldon. "The end result is a clearer line with more signal margin to reduce the usual static."

Already, Dean's project has sparked interest from some of the major mobile phone providers, with quotes sought from international quarters.

"I used to work as a technical officer for Telecom, installing and commissioning mobile phones and solar powered phones in central and western Queensland", said 35-year-old Dean. "Working on other people's designs was frustrating. I knew I could do it myself, but I needed more knowledge — so I enrolled at Griffith. It's been terrific. The course will get me where I want to go."

Messaging system

THE WORK OF two other IAP students could speed up evacuations and possibly save lives in emergency situations. Microelectronic engineering students Leigh Alsteris and Sulaiman Thompson teamed up with local business Creative Audio to develop an amplifier system capable of broadcasting sequences of pre-recorded messages over a PA system.

Leigh envisaged the software he'd developed, along with Sulaiman's hardware would be best used in emergency situations. "Essentially what it means is that evacuation officers can concentrate on moving people out, rather than broadcasting mixed messages from a central call point. In reality, people will be evacuated much faster", the 21-year-old said.

In his 15 weeks with Creative Audio, Leigh created a graphical user interface in Windows 95 which manages messages and sequences on Sulaiman's module, installed in an amplifier. "There's a few products like it on the market already, but this one doesn't need a separate power source and it's less expensive to make", Leigh said.

No stranger to the electronics industry,



Gary Moroney of Brisbane Transport (L) with IAP students Patrick Hennings and Darren Verner, with one of the PCB modules from the project they worked on.

Leigh has worked with the Australian National University on a scholarship program carrying out research on improving the information flow to satellites.

Phone call billing

BUSINESSES MAY WELL achieve big savings in their telecommunications budgets, due to the ingenuity of IAP microelectronic engineering students Michael Lindstrom and Shane Murray. The pair

teamed up with The Communications Company to make savings more accessible to smaller businesses.

Michael's Windows software program will allow hotels to calculate their customers' calls fairly, regardless of which telephone company they use. "At the moment, many hotels use Telstra because their telephone lines are the only ones that provide a periodic pulse, which allows hotels to calculate the cost of the call", Michael said. "My program determines the cost of the call on Telstra and on any other carrier by emulating the pulses, costing the call and displaying it in a report format."

Since The Communications Company first came up with the idea in February, the program has germinated into what it is today — a polished product with orders rolling in from as far away as south-east Asia.

Michael pointed out that the program is also likely to boost revenue for hoteliers. "Currently a person can make a call from their hotel room to a destination on a non-Telstra line and not be correctly charged for it", the 21-year-old said. "By using my program, hotels are tapping into a relatively untouched market."



IAP students Leigh Alsteris and Sulaiman Thompson with Neil Packer (R) of Creative Audio, where the students developed software and hardware for a PC-driven automated messaging system.

L to R: IAP students Darryl Main, Melinda Lusmore and Jonathan Coleman with Telstra's Rob Shergold.

Fellow Griffith student Shane Murray can also claim massive corporate savings through his work with The Communications Company, which resulted in a program allowing companies to integrate voice-mail into older telephone systems — sparing companies the expense of upgrading their entire telecommunications network. Tested in one hotel, Shane's program saved the company close to \$60,000.

"Technology is growing so rapidly, making this a really exciting field to be a part of. Fortunately, the course gave me such a huge knowledge-base to begin my career", the 22-year-old Jimboomba resident said.

Both Shane and Michael agreed that their IAP involvement could only improve their job prospects.

Healthcare boost

THE HEALTHCARE industry is about to have a technology injection, due to the work



of 10 IAP students who worked in conjunction with MicroMedical Industries. MicroMedical Industries is a Labrador (Gold Coast) based international manufacturer of ECG recorders and associated devices.

While at MicroMedical, the students were involved in the development of a variety of new initiatives. These included an ultrasound device for use in the veterinary market, a heart rate recorder for patients suffering sleep apnoea and a memory jogger which has the potential to be incorporated into cardiac rehabilitation programs worldwide.

Student Melanie Butt spent her time at MicroMedical developing a device which could possibly save lives with its accurate patient readings. The Vital Signs Monitor or VSM allows medical practitioners to accurately measure patient oxygen saturation levels as well as an accurate heart rate reading. Melanie's device has been incorporated into one of MicroMedical's main devices,

the Biolog, which allows practitioners to have access to a handheld, portable device that will save time, money and lives.

As one of very few women in her combined Bachelor of Information Technology and Microelectronic Engineering degree, Melanie has made sure that nothing has stood in the way of success. "My father and stepfather are both engineers. Their role in my life has negated that whole idea of career obstacles based on gender. It has barely even crossed my mind in this industry. I haven't even had to think about it", Melanie said.

On completion of her course, Melanie hopes to work in either communications or computer science.

Virtual factory website

FOR HIS IAP project, Griffith University's Marcin Metter rebuilt the website of manufacturing firm Oz Electronics, making it

TAP INTO OUR RESOURCES

The Industrial Affiliates program at Griffith University, invites industries to offer work to final year Microelectronic Engineering students for a period of three months. The students work with industries, producing research and design solutions from concept to prototype. In the past six years, 200 Griffith students have worked on industry projects from the conceptual stage through to completion of prototypes. Industry projects are now being accepted for the next program.

To tap into these resources, contact Carol-joy Patrick on telephone: (07) 3875 5007, fax: (07) 3875 6726 or email: cj.patrick@sct.gu.edu.au



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more friendly and building the foundations for the company's innovative 'virtual factory'. 22-year-old Marcin was given the challenge of building the new site as a virtual factory, with 'electronically transparent walls':

"The final step for Oz Electronics is to build a site where customers can see the progress of their orders through the entire manufacturing process", Marcin said. "My aim was to make the site more accessible to a larger variety of customers, as well as giving suppliers access to the stock database so they can fulfill their orders electronically", the Rochedale South resident said.

"Oz Electronics are acutely aware of the value of the Internet in business operations. The new Web site will go a long way in attracting future clients and keeping current ones clear about the services on offer."

Marine projects

THREE FURTHER Griffith Uni students spend their IAP time working to ensure that the serious fisherman has little else to think about than the size of his catch. Steven Duncan and Shaun Westerveld — both of Nathan — and Jimmy Thai of Marsden were embroiled in the challenge of putting the leisure back into the fishing industry. The microelectronic engineering students joined

up with marine technology company TMQ Electronics, to work on three separate sea-bound projects.

For 21-year-old Steven, designing an autopilot system for commercial vessels has been his greatest achievement in a lifetime of tinkering with electronics. Aimed at the pleasure boat market, Steven's autopilot system employs the Global Positioning System and displays the vessel's current location as well as basic information including the speed and course of the boat on an LCD screen.

As a component of Steven's autopilot system, classmate and friend Shaun Westerveld was given the challenge of improving existing compass capabilities.

"In rough seas, the standard Flux Compass can give a reading which can be 10 degrees inaccurate", Shaun said. "I've managed to get that error margin down to four degrees. "In the big picture, any increase in the accuracy of navigation equipment will improve the safety of marine vessels."

A seasoned skipper, 21-year-old Shaun values the importance of an accurate compass. "I practically grew up on boats. My childhood on the water has inspired me to work in the marine industry"

Fellow student Jimmy Thai has also helped reduce the marine margin of error, by

developing a circuit which allows fisherman to track their fishing lines in the water.

"My circuit will let fishermen know exactly where the fishing line is positioned and how far away from the vessel their lines are", 20-year-old Jimmy said. "They don't have to worry about their line being swept away or lost if this circuit is attached."

Jimmy's circuit is installed in a fishing line buoy and sends information via a radio network to a personal computer on the boat.

All three projects have attracted significant industry interest, resulting in full-scale production of each.

"I can remember thinking what a waste of time some of the things I learnt at Uni were," Shaun said. "But these past 15 weeks with TMQ have proven what value this information has been. I realise now that the type of job I'm seeking hinges on that extra knowledge I've stored away."

Who to call

ORGANISATIONS interested in being part of Griffith University's Industrial Affiliates Program can contact program manager Carol-joy Patrick at the School of Microelectronic Engineering, Faculty of Engineering, Griffith University, Nathan 4111. (Phone (07) 3875 5007, or e-mail at cj.patrick@sct.gu.edu.au). ♦

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Here's a sampling of interesting products recently announced by Queensland firms, plus a listing of the firms and organisations who responded to our invitation, showing their contact details plus a summary of their main products and services.

Powerful PIGMG board

The new 686LCD/MG Single Board Computer (SBC) from Inside Technology is claimed to set a new benchmark in the PIGMG standard, packing the features of a desktop PC into a tiny embedded package only 250mm long.

The 686LCD/MG supports processors from Intel and AMD (including the 233MHz K6), and provides on-board VGA support for both CRT and LCD. It can have up to 512MB of DRAM and provides a 40MB/s ultra-wide SCSI controller, USB, IrDA, Ethernet and interfaces for PCI, ISA and PC/104.

Along with the standard features, the board offers the latest technology in LCD interfacing, Direct Video Input, and CPU monitoring. The extra LCD interface is called PanelLink; it introduces the LVDS standard, which reduces EMI problems when transmitting TFT data signals at a frequency above 30MHz between the SBC and LCD displays over 50cm. The maximum SBC-LCD distance achieved by PanelLink is 10 metres.

For more information circle 201 on the reader service card or contact Baltec Systems, 8/87 Webster Road, Stafford 4053.

Power conditioners

Precision Power's range of power conditioning and power line surge diverters cover the range from 16A per phase to 300A per phase,

and provide power related disturbance solutions for a wide range of applications. They have been developed in Australia by Precision Power specifically to meet the needs of firms and organisations in Australia and Asia.

Founded in 1982, the company is quality endorsed to ISO 9000 and is actively involved in research and development. Its products have been sold very extensively in Malaysia, Thailand, Papua New Guinea and other Asian and South Pacific countries, as well as within Australia.



The Precision Power range includes surge diverters, power line filters, power conditioners and uninterruptible power supplies, with many options covering power capability and the needs of users in areas such as educational facilities, offices, hospitals, laboratories and factories. The company has a support and distribution network with

branch offices in Sydney and Melbourne.

For more information circle 202 on the reader service card or contact Precision Power, Unit 6, 72 Riverside Place, Morningside 4170.

Half-size SBC

Inside Technology's 686LCD/S board is claimed as the industry's most powerful PC-compatible single board computer (SBC), offering workstation performance for flat panel applications and embedded systems. It supports CPUs from Intel (Pentium, Pentium MMX) and AMD with speeds up to 233MHz.

Features include on-board Ethernet, M-Systems Flash Disk, 4MB video RAM, USB and up to 128MB DRAM, plus interfacing for the PCI, ISA and PC/104 bus standards. The on-board graphics adaptor provides VGA support for both CRTs and LCDs — the latter via a PanelLink interface capable of driving an LCD up to 10m away.

The 686LCD/S offers automatic processor detection and power supply setup, flat-panel switching (3.3/5V), processor temperature and fan supervision. It supports all popular operating systems including MSDOS, Win3.XX, Win95, NT, OS2, AMX, QNX, VXworks and PSOS, and incorporates the Intel Triton II chipset (430HX).

For more information circle 203 on the reader service card or contact Baltec Systems, 9/87 Webster Road, Stafford 4053.

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The Software Repair is expected to have a street price of \$95, and the Hardware Repair a price of \$190.

All components in the system have received a 100% rating from the British Task Force 2000.

For more information circle 204 on the reader service card or contact Manacomm, Unit 23 Milton Village, Lang Parade, Milton 4064.

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9/87 Webster Road, Stafford 4053. Phone (07) 3356 8111, fax (07) 3356 8777. Contacts: Alan Plato, Sharon Lodge.

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Campad Electronics

PO Box 269, Capalaba 4157. Phone (07) 3245 2008, fax (07) 3832 3428. Contact: Paul Alick.

Services provided by Campad Electronics include electrical and industrial electronics power supplies (linear and switch mode), prototypes including computer monitors, and service and repairs to electrical and electronic equipment, and PCB modules.

Cliff Electronics

PO Box 732, Fortitude Valley 4006. Phone (07) 3252 3178, fax (07) 3252 3165. Contact: Paul Montague.

Cliff Electronics offers the Cliff Components range of audio hardware, complemented by a wide range of electronic hardware and test equipment from Fluke, Black Star, AEMC, Kepco and others. It also supplies Penn Fabrications flight case hardware.

Colorview Electronics

5 Commerce Street, Salisbury 4107. Phone (07) 3275 3188, fax (07) 3275 3033. Contact: Bob Heelan.

Colorview Electronics is a broadline stockiest of industrial electronic components and equipment for the electronics manufacturing and maintenance markets. Primary product lines are test and measurement equipment, harsh environment connectors, power semiconductors, NTE replacement semiconductors and relays, fans, and soldering and desoldering equipment.

Delsound

1 Wickham Terrace, Brisbane 4001. Phone (07) 3839 6155, phone (07) 3832 5278. Contact: Trevor Dellitt.

Delsound was established in 1970 as a supplier of sound intercom and video systems. Since then it has expanded considerably to become a major importer and supplier of electronic parts and components, computer accessories, sound and intercom systems (both hire and install), and communications equipment.

Griffith University

Industrial Affiliates Program, School of Microelectronic Engineering, Griffith University, Nathan 4111. Phone (07) 3875 5007, fax (07) 3875 6726. Contact: Carol-Joy Patrick.

Griffith Uni's IAP is widely acknowledged as the Queensland industry's avenue to research and design solutions, from concept to prototype. Final-year students work on industry projects in this highly acclaimed industry/university program. The program is inviting project applications for 1999 now. ♦

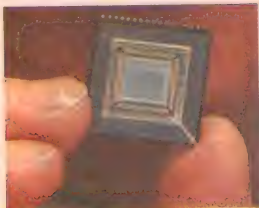
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Silicon Valley Newsletter.....

Texas Instruments will have 0.07um ICs by 2001...

RESEARCHERS AT Texas Instruments say they've built a new class of transistors using a geometry of just 0.07 microns, 1/3 the size of today's most advanced circuits — which feature transistors with 0.18-0.25um features. TI said it hopes to have ICs based on the 0.07um technology in production in 2000, with volume capacity by 2001.

If successful, the move would put TI two to three IC production generations ahead of the rest of the semiconductor industry. It could force many already cash-strapped chip companies to invest heavily, to match TI's achievement or risk falling one or more chip production generations behind. The breakthrough will enable TI to make circuits with more than 400 million transistors, four times TI's current 0.18um ICs. Such ICs would vastly increase the power and performance capabilities of many electronic devices, including cellular telephones — which would be able to combine audio and video. TI said it could build an entire computer on a chip with a performance level of 1GHz.

"The new 0.07 micron technology will keep TI in the forefront of high-performance manufacturing", said Yoshio Nishi, director of TI's research and development. "The ability to pack 400 million transistors on a single, low-voltage chip will push high-speed wireless and multimedia communications far beyond the limits of today's technology."

However chip production market analysts and industry executives have questioned whether TI will be able to meet the extremely aggressive production plans. While it is relatively easy to produce prototypes of extremely small and complex circuits in an R&D laboratory, transferring the technology to the production floor is one of the most complex operations in the chip-making process. In fact, many key production tools, such as lithography, etch and CVD systems capable of producing such tiny devices reliably in high volume are simply not yet available.

Bill O'Leary, a spokesman for IBM Microelectronics, said many unsolved issues exist that could delay or prevent transistors

from being built below 0.10um. "There are a lot of issues in getting down below 0.10. It will certainly be interesting to see how TI plans to resolve them."

"This is a pretty aggressive transition, to go from 0.18 down to 0.07 in two to three years", said Jim Feldhan, president of Semico Research Group, a Phoenix-based semiconductor research firm, in an interview. But he added that TI has proven before that it can meet production scheduled deemed impossible by the experts. TI started production on 0.18um devices 18-24 months ahead of others in the chip business; when those plans were announced in 1996, they were met with similar skepticism.

TI will be using copper interconnect in the new generation of ICs, adding even more speed to the vast performance increase made possible by the leap in transistor density. But copper is also a key factor in the TI achievement. The use of copper for the interconnects that link different parts of the chip boosts performance by 30% or more. But with its vastly lower power dissipation, copper also allows transistors to be packed

First copper ICs hit the market

COPPER HAS ARRIVED in the semiconductor industry, as IBM shipped the industry's first ICs that use copper instead of aluminum to connect different groups of transistors on a chip. The first ICs being shipped with copper interconnects are PowerPC 740 and 750 processors operating at 400 megahertz. The PowerPC 750 features cache and is target-

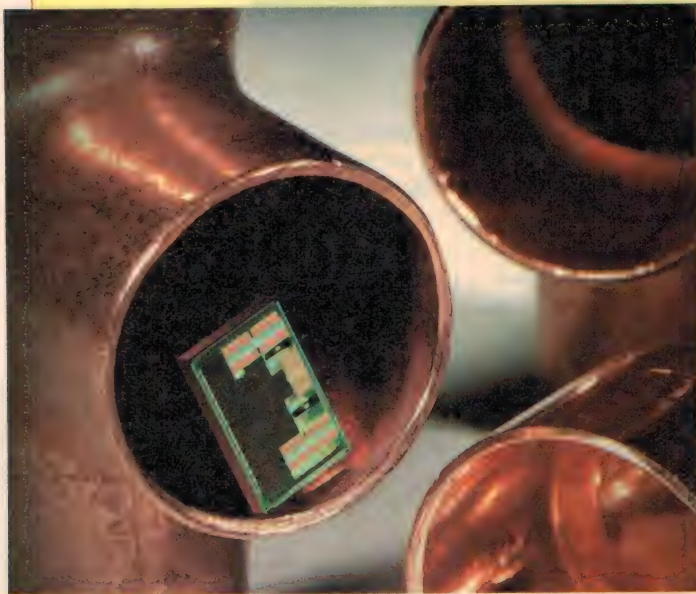
ed at desktop and mobile computers, networking and telecommunications devices. The cache-less PowerPC 740 is designed for handheld devices. The chips are identical to earlier aluminium-based versions that run at 300MHz. The copper interconnects have boosted performance by a full 100MHz, while consuming 58% less power.

Apple Computer is expected to be among the first customers for IBM's copper PowerPCs. Another early adopter is IBM itself, which hopes to further boost the power of its mainframe computers by using copper in the interconnects of the ICs that power its S/390 mainframe, as well as the AS/400 and the RS/6000. A prototype copper-based mainframe is expected to be announced this year, with customer deliveries starting in 1999.

"IBM is first into the market with any kind of credible copper manufacturing technology," said Dan Hutcheson, president of VLSI Research, a Silicon Valley semiconductor market research firm.

Others are not far behind. Hitachi and Intel are said to be working frantically to ready their first copper based chips. TI's new 0.07um technology is copper-based, and AMD recently acquired a licence to use Motorola's copper technology, which it is said to be planning to incorporate in future K6 and K7 microprocessors. IBM will also implement the copper process in its foundry operations, which make ICs for other chip makers.

"What's most significant is that they got copper out a year after they announced it", said Tony Massimini, an analyst with Semico Research, a Phoenix-based research firm. "It makes copper very credible."





IBM has just released this super-small hard disk drive, with overall dimensions of just 42.8 x 36.4 x 5.0mm, and a weight of only 20 grams. It can store either 170 or 340MB, and looks set for use in digital cameras, handheld PCs and many other portable digital devices...

much closer together without increasing the risk of a melt-down.

The additional density also results in a huge leap in chip performance. Add to that the ability to make transistors smaller by a factor 3 or 4, and TI will be able to produce components with potentially fantastic performance and capability improvements.

By moving from 0.18 to 0.07µm, Texas Instruments is leapfrogging both the 0.13 and 0.1µm generations of devices which are next on the technology roadmap of virtually every chip company, most of who are just barely getting into 0.25 micron production. Most IC makers were not planning sub-0.1µm capabilities for until around 2005.

Dan Hutcheson, president of VLSI Research in San Jose said TI is throwing the entire industry for a loop. "They are throwing down the gauntlet and challenging others to pick up the pace."

Many major IC manufacturers, in the midst of one of the worst chip recessions, will face major difficulties in raising the necessary capital to match TI's production schedule. If it can deliver, TI could significantly boost its ranking in the chip market.

Germany's Siemens sues Korea's LG Semicon

GERMANY'S SIEMENS has filed a patent infringement lawsuit against LG Semicon, in which the Korean firm is accused of misusing seven Siemens DRAM-related IC patents that were issued from 1986 to 1997.

The lawsuit was filed in the US District Court in Wilmington, Delaware. The suit could be filed in the US because Siemens sells chips through its US-based Siemens

Microelectronics unit in Cupertino. LG allegedly sells the chips in question through San Jose-based LG Semicon America.

"We have invested substantial resources in designing, patenting and manufacturing DRAMs, and have a patent portfolio representing billions of dollars in R&D investment", said Siemens officials. "We will not let LG Semicon use unlicensed technology developed and paid for by Siemens."

Hitachi, Mitsubishi pull out of chip ventures

WITH NO END in sight to the three-year crisis in the DRAM memory market, the painful restructuring of Japan's DRAM semiconductor industry has continued with Hitachi consolidating two of its US plants and closing a third, while Mitsubishi closed its DRAM factory in Durham, North Carolina. Some 1000 US workers will lose their job as a result of the moves.

Hitachi said it is combining two US fabs and closing a third one in Texas. The remaining operation will focus on microprocessors for hand-held computers, electronic games and other devices. Hitachi Semiconductor America will be combined with Hitachi Micro Systems, a chip-design and engineering unit, to form Hitachi Semiconductor America. The new unit will be based in San Jose and have 370 employees. Earlier this year, Hitachi abandoned the Twinstar Semiconductor joint venture with Texas Instruments.

"Companies are losing their shirts in memory chips", said Dan Hutcheson, president of VLSI Research in San Jose.

Meanwhile, Mitsubishi Electric said it will close the Durham plant on November 6 as part of a plan to centralize memory-chip assembly and test operations in Nagano, Japan. The company closed another DRAM manufacturing plant in Durham earlier this year.

Applied loses 2000, Lam loses just one

SANTA CLARA-BASED Applied Materials, the world's largest semiconductor production equipment company, is laying off about 15% of its workforce — equivalent to 2000 people — as the recession in the chip equipment industry appears to be getting worse. A few miles away in Fremont, Lam Research said its long-time chairman Roger Emerick has handed over his last active post of chairman to James Bagley, 59, who had previously assumed Emerick's position as chief executive officer. Emerick, also 59, said he is retiring but will stay on as a director on Lam's board.

Applied Materials said most of the cuts will be made at its headquarters (750 people) while another 600 positions will be cut at its plant in Austin, Texas. The rest of the redundancies will be spread out over various Applied facilities around the world. ♦

Jobs says iMac sales are 'off the charts'

APPLE COMPUTER'S new iMac system is selling so fast, the company's factories cannot keep up with demand for the stylish US\$1300 all-in-one machine, said Apple interim CEO Steve Jobs at the Seybold Desktop Publishing Conference in San Francisco. In fact, the machine has proven particularly popular in Asia, where it is being deployed broadly in desktop publishing applications.

"We have had a phenomenal response to this. We cannot keep up with demand", Jobs said.

Jobs also unveiled several key new features of the next upgrade of the Macintosh OS 8.5 operating system, due for release in October. One new feature, known as 'Sherlock', enables a user to ask many Internet search engines simultaneously to find information. Sherlock lets a user ask a question in a natural language, such as 'Why is the sky blue?' and it can then simultaneously search AltaVista, Excite, Infoseek and HotBot.

"Sherlock is so cool it's worth buying OS 8.5 just for this. We think Sherlock is a really big deal."

Mac OS 8.5 will also include improved ColourSynch technology, a what-you-see-is-what-you-get technique that lets printers produce hardcopies that display colours matching the tones and hues on the display.

The OS upgrade will also include improved AppleScript, which lets users write scripts for application programs to automate a number of otherwise complex tasks.

Varian splits into three

VARIAN ASSOCIATES, one of the oldest and most respected high-tech companies in the Silicon Valley, has announced that it is splitting itself up into three new companies. The dramatic move is the result of the impact on Varian of the severe recession in the semiconductor equipment market.

The three new operating units will focus on health care systems, semiconductor equipment and various scientific instruments, respectively.

Varian CEO Tracy O'Rourke said the spin-off would give each business a sharper focus on their markets, customers, costs and growth potential. "This should help boost Varian's value and its stock price", he said.

Varian, which employs 7100 people worldwide, had sales of US\$1.4 billion in 1997. It earned only \$28.2 million in its most recent quarter.

Digital Electronics CD-ROM from Matrix



Back in the January 1998 issue of *EA*, I took a look at the *Electronic Circuits and Components* and *The Parts Gallery* educational CD-ROM, produced by Matrix Multimedia. Well, the latest in the series has recently been produced, titled *Digital Electronics*, and it capably continues on from where the previous one left off...

by Graham Cattle

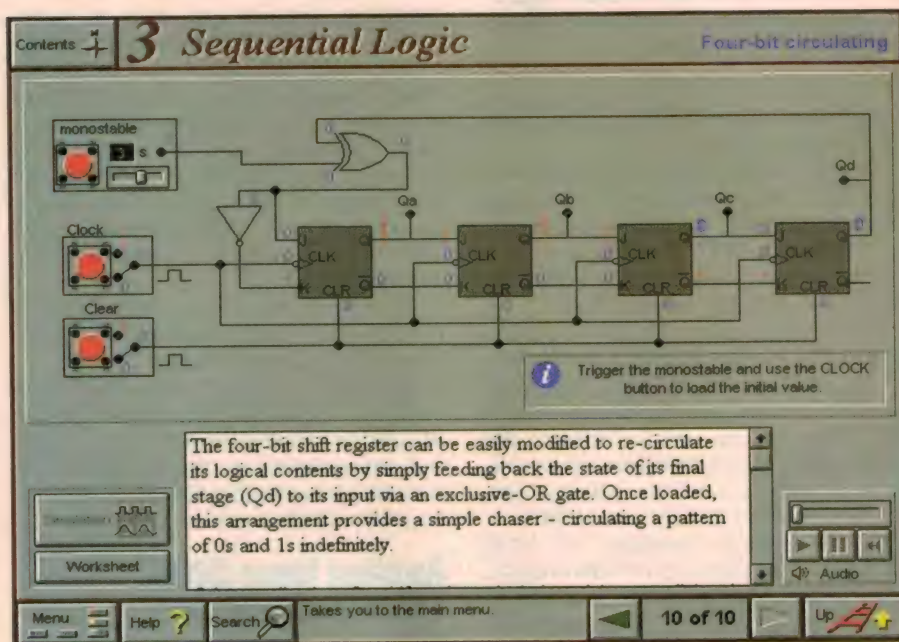
IN THAT original review, I said that it was probably inevitable that electronics textbooks would be appearing on CD-ROM. But looking back over the last year or so, I've realised just how few educational CD-ROMs there have been in the electronics field. All the more reason then, to take a look at the latest of Matrix' CD-ROM based texts, *Digital Electronics*. This is the third in a series of four planned releases, and it attempts to focus the digital field a lot more thoroughly than the rather wide ranging *Electronic Circuits*.

So, what's new? Well, for starters, the main control panel sports a couple of new buttons (namely Search and Help) and the circuit export options now include the new Crocodile Clips, as well as the ever-popular Electronics Workbench. Apart from that, though, the user interface is the same as before, and just as intuitive to use.

Digital Electronics runs on any Windows 3.1x, Win95 or NT machine, with a minimum of 12MB RAM, and takes up a reasonably small 10MB of hard drive space. And if you install the network version (available separately), you don't even need the disk space on the individual workstations. This makes it attractive for schools and tertiary institutions, as the setup and installation time is virtually nil.

Once you've installed *Digital Electronics* you are presented with a main menu, and a row of buttons linking to the four main chapters in the program. These cover digital fundamentals, combinational logic, sequential logic and the rather nebulous digital systems. Each of these links direct you to a series of pages, with each one dealing with a particular concept or circuit.

With each chapter covering around 30 pages, you wouldn't expect a fully compre-



This page (one of the dozens in the package) demonstrates just about every feature of the Digital Electronics package. You can see the buttons for exporting the circuit, printing a worksheet, playing the audio narration, help, search and navigation, as well as the buttons and sliders in the circuit itself.

hensive lesson in the subject, but *Digital Electronics* (like the previous *Electronic Circuits*) offers much more than any conventional textbook.

Just about every page contains an interactive circuit diagram, which may range from a simple AND gate to a traffic light controller, along with an assortment of knobs, buttons and switches. Clicking on these controls affects the circuit's operation in real time, which gives you a good feel for what's happening and hammers home the concepts in a way that no textbook ever could.

Scattered throughout the various sections

are spot test questions, with fully worked answers available, and most of the more complex circuits offer a circuit export facility.

This automatically opens either the Electronics Workbench or Crocodile Clips circuit simulation packages, and automatically loads in the circuit. You can then print out one of the many assignment sheets and follow through by modifying the circuit as described. It's all very interactive, and seems to work.

Of course you don't need to have EWB and the like to use *Digital Electronics*, as the interactive nature of the circuits presented is enough to keep you busy for hours.

One demonstration that I particularly liked was the 'Scrambler' — an EXOR data encoder/decoder that used an 8-bit circulating key. When switched to automatic mode, this simple circuit brought to life what has always been to me a rather static circuit; it was after some 20 minutes that I realised that I was supposed to be evaluating the program, not enjoying myself...

I think that it's this sort of thing that emphasises the difference between this CD-ROM and an ordinary textbook on the subject, and as such I recommend it as fully as I did *Electronic Circuits and Components*. If this level of quality is anything to go by, Matrix' next CD-ROM *Analogue Electronics* will be just as popular when it is released sometime in the near future.

Bad points?

I FOUND remarkably few problems with *Digital Electronics*, the only one worthy of note being that I managed to break the counter widget on the 'Binary system' page. This righted itself when the page was re-visited, so it was no big deal...

The only other point I would raise was the whirlwind tour of Karnaugh maps. These are a difficult concept to grasp and use effectively, and I would have liked to have seen a few more pages devoted to the subject (particularly as the CD is only about half full).

There was also only a cursory look at CPUs and PICs, but reference was made to an upcoming 'Matrix Pictutor' CD; this more abstract side of digital electronics will no doubt be explored in this (fourth?) release.

Still interested? I hope so, because I think the whole concept works very well, and the CD would certainly be worth getting if you are just starting out in digital electronics. If you want to try out a demo version of *Digital Electronics*, hop along to <http://www.emona.com.au>, where you can download it free from their 'Hot Spots' section. ♦

Digital Electronics CD-ROM

An interactive learning package produced by Mike Tooley.

Good points: Fun, straightforward and easy to use.

Bad points: A bit brief in some sections, but nothing drastic.

RRP: \$129 for single user.

Available: Emona Instruments, PO Box 15, Camperdown NSW 2050. Phone (02) 9519 3933, Fax (02) 9550 1378 or email testinst@emona.com.au. Web site at <http://www.emona.com.au>.

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Computer

News & New Products

1440 x 720dpi inkjet uses three drop sizes



Epson's new Stylus Color 740 inkjet printer gives small office and home office customers 1440 x 720dpi printing, even on plain paper. The company's new variable-sized droplet technology, an enhancement to its Micro Piezo technology, delivers a combination of small, medium and large ink droplets to give greater detail and smoother halftones.

The three-size droplet technology is controlled according to the tone level: high-density areas of solid colour are printed with large (19 picolitres ink droplet) or medium (10pl droplet) dots, while medium-low density areas are printed with small dots (6pl droplet). This is claimed to achieve the highest image quality while optimising for speed.

The Stylus Color 740 supports both Windows and Macintosh operating systems. It has parallel, Mac Serial and USB (Universal Serial Bus) ports. It's claimed to print a 6" x 4" colour photo in 2 minutes and 11 seconds. The number of black nozzles has been increased to 144 and the colour nozzles increased to 48 per colour.

Other enhancements include a watermark function for printing colour watermarks; a fit-to-page function for printing enlarged or reduced documents; and a print-layout function for printing multiple pages on a single sheet. The 740 can print with a border of only 3mm on all four sides.

The Epson Stylus Color 740 is available at retail outlets nationwide at an estimated street price of \$599 including tax. It comes with a standard 12-month warranty.

Compact business PCs from HP

Hewlett-Packard has announced a line of high-powered HP Brio business PCs featuring cutting-edge technology and full-featured configurations. Based on Intel's current Celeron processor technology, the line also will feature future Celeron processor speeds when they are introduced. They are expected to have an estimated street price including sales tax of \$2449 (including 15" monitor).

The new HP Brio 7000 PC series uses what's claimed as an industry-first subcompact 'microtower' design. The unit stands no higher than a standard office binder — about half the size of a typical tower-style PC. The sleek, space-saving models are exceptionally



quiet and small enough to be placed either on a desk or below without sacrificing system expandability or performance.

Features include the industry's fastest ReWriteable CD-ROM drive, and a 10.1GB Ultra-ATA 7200rpm hard-disk drive. The entry-level model comes loaded with an Intel Celeron 266MHz processor, 32MB of SDRAM expandable up to 256MB, a 2.1GB UltraATA hard-disk drive, Matrox G100 AGP graphics with 2MB VRAM, 16-bit SoundBlaster Pro-compatible sound, a 10/100Base-T LAN adapter and Microsoft Windows 98 — all for an expected estimated street price of only \$2499. Customers can choose HP Brio 7000 series PCs from a range of Intel Celeron and Pentium II processor-based configurations that include hard-drives up to 8GB, and fast (32x max) CD-ROM drives.

HP Brio PCs are backed by a three-year limited warranty. For more information on HP products and services, circle 160 on the reader service card or call HP's Customer

Call Centre on 131 347 (no STD area code required, from anywhere in Australia).

Low cost inkjet offers photo quality

The new Epson Stylus Color 440 colour inkjet printer offers first-time home users, students and families 720 x 720 dpi printing at an entry-level price of \$299 including tax. The new colour inkjet comes standard with photo-quality output, which lets customers print their favourite photos, greeting cards and full-colour documents without the expensive price tag.

The 440 is a four-colour printer, printing in CMYK using a dual-cartridge system. This means customers can print true black — not a mix of colours to make pseudo-black. Users can also replace the black or colour cartridges separately; they don't have to waste the colour cartridge if only the black runs out.

The new printer also features an 'Automatic' mode, which takes the guesswork out of setting the printer driver. When selected, the printer driver software scans the page to be printed and automatically chooses the best settings for each item — image, text, graphics — to give customers the best print quality for their document.

The 440 can print with a border of only 3mm all around, allowing it to print photographs with only a marginal, photo-like



border. It also prints on a range of media, from plain paper to Photo Quality Glossy Film.

Designed exclusively for Windows, the Stylus Color 440 supports Windows 3.1x, 95, 98 and NT 4.0. It's available at retail outlets nationwide and comes with a standard 12-month warranty.

Improved keyboard

Designed to cut down on desktop clutter, the New Touch keyboard from Logitech Australia offers an elegant split-wave design with



quiet, full-size keys; palm rest;

and an extra tab set for smaller hands. An integrated 'SpeedScroll' touch-pad also provides the functions of a three-button wheel mouse.

The New Touch key layout is contoured and split to allow more natural wrist positions while typing. The curved palm rest is designed to reduce fatigue, providing a place for users to relax their wrists during typing breaks. Adjustable levelers create the negative slope recommended by ergonomists for reducing wrist strain.

The SpeedScroll touch-pad provides the advanced navigational capabilities of a wheel mouse and the convenience of three mouse buttons without requiring additional desk space. Users move a finger along the pad to scroll horizontally and vertically, or zoom in Windows 95, Windows 98, and Windows NT 4.0 applications. Smart edges allow the cursor to continue scrolling after the finger reaches the edge of the touchpad. By tapping the pad with one, two, or three fingers, users can perform the functions of left, middle, and right mouse buttons. Included Logitech Key-Commander software makes the 12 function keys userprogrammable.

The New Touch keyboard is available now from Logitech dealers and distributors at a RRP of \$149.00. For more information circle 161 on the reader service card or contact Logitech Australia, Level 2, 633 Pittwater Road, Dee Why 2099.

Starter kit for SCADA development

National Instruments has announced a new combination software and hardware package for SCADA systems developers seeking effortless, timesaving configuration in their applications. The SCADA Starter Kit combines the company's easy-to-use Lookout industrial automation software with FieldPoint intelligent distributed I/O hardware, for a powerful SCADA system solution that developers can have up and running in minutes.



Automation hardware included in the kit includes a 50 I/O development/run-time server system; continuous, discrete, batch, and SPC object classes; Lookout Industrial Citadel and spreadsheet historical collection with SQL/ODBC data access; and HyperTrends with combined real-time and historical trending.

Also in the kit is a network interface mod-

ule with RS-232 connection (FP-1000); an 8-channel 16-bit analog input module (FP-AI-110); an 8-channel discrete input module (FP-DI-330); an 8-channel discrete output module (FP-DO-400); FieldPoint Explorer configuration software; and a power supply, serial cable, and mounting hardware.

For more information circle 162 on the reader service card or contact National Instruments Australia, PO Box 466, Ringwood 3134.

Low cost 10ppm laser printers

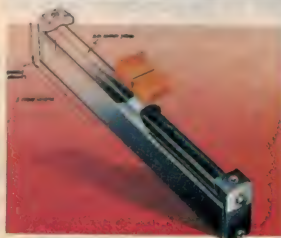
Brother claims to have made a quantum leap in laser printing technology, with three new sub-\$1000 models achieving a rated speed of 10 pages per minute. The new HL-1040, HL-1050 and HL-1070 are fully featured printers to suit the latest business needs for both SOHO and corporate users. All three feature fast CPUs, such as a 66MHz processor on the HL-1050/1070, plus a first print time of less than 15 seconds.

The HL-1040 features true 600dpi resolution, while the HL-1050/1070 have 1200dpi class resolution. Combined with High Resolution Control, Brother's Advanced Photoscale Technology and microfine toner, the three new printers are claimed to provide true business quality printout.

The HL-1040 has 2MB of memory while the HL-1050/1070 have 4MB as standard, which is upgradable to 36MB memory using industry standard SIMMs. In addition to a standard IEEE 1284 high speed bi-directional parallel interface and optional RS-232C/422A (Apple) serial interface which is available for all three models, the HL-1050/1070 have the latest USB port as standard to suit the needs of the future.

All models come with Windows 3.1,

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Computer

News & New Products

3.11, 95/98 and NT 4.0 drivers and can be used in both Windows and DOS environments. HL-1040 has PCL4 as standard plus PCL5e software included, while HL-1050/1070 have the latest PCL6 compatibility. The HL-1070 also comes with PostScript Level 2 emulation as standard.

List price on the HL-1040 is \$533, while the HL-1050 is \$711 and HL-1070 is \$889 (all excluding tax). For more information, circle 163 on the reader service card or contact Brother International (Aust), 7 Khartoum Road, North Ryde 2113.



Monitors are digitally controlled

Intecolor's new HERC Series of monitors are built to withstand even the most demanding environmental applications. HERC stands for 'Harsh Environments & Rugged Conditions', and Intecolor has designed the monitors to allow user control of contrast, brightness, colour balance, vertical and horizontal size and other display parameters remotely via an RS-232C serial port. The monitor can be digitally queried for a detailed report of operating parameters including deflection frequencies, control settings and even internal temperature.

For more information on the HERC Monitors circle 164 or contact Intelligent Systems Australia, PO Box 118, Berwick 3806.

Unbelievable? (but true!!)



For less than the cost of the former market leaders, which don't have pin-drivers on all pins, you can buy the Xeltek SUPERPRO III universal device programmer, which does have individual pin-drivers on all 48 (or optionally 100) pins! Manufacturer-approved algorithms added/updated regularly; supports 4000+ devices incl. PLDs and MCUs; runs from a parallel port; DOS and Win95 software; tech. info. & free software updates: www.xeltek-cn.com.

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Surround audio authoring tool

Lake DSP's new Audio Display Tools (ADT) software allows production of truly three-dimensional audio performances for large audiences over multichannel speaker systems. Using newly-developed proprietary techniques, the company's 3D spatial audio technology gives sound designers unprecedented flexibility in the creation of exhibitions, theme park rides, theatre and special purpose audio presentations.

With Lake's ADT system, users experience fully immersive, three-dimensional audio when listening from virtually anywhere in the presentation area. Multiple sounds move through the room from far in the distance or up close, and can move freely above and around you. From the diffuse, surrounding patter of light tropical rain to the pin-point localization of voices and musical instruments, the system is claimed to deliver the richest possible surround sound experience.

Targeted at theatrical audio professionals, attraction content suppliers and special-purpose PA engineers, the ADT system features an easy-to-use graphical 3D representation of the trajectories of up to 32 independent sound sources as they move around the audience.

Running under Microsoft Windows NT 4.0 or later, the Sonic Animator component of the ADT system synchronizes with external SMPTE or MIDI Time Code and has a range of structured pre-set movements such as 'flybys' and circles. The ADT software runs on Lake DSP's range of Huron Workstations and produces high-quality 24-bit digital or professional analog audio as output.

For more information circle 165 on the reader service card or contact Lake DSP, Suite 502, 51-55 Mountain Street, Ultimo 2007.

USB-based data acquisition systems

Intelligent Instrumentation has released a new family of USB data acquisition systems. Designed with ease of use and portability in mind, the systems provide an attractive alternative to plug-in data acquisition boards. They use the increasingly popular new Universal Serial Bus (USB), which offers hot-swappability and true plug-and-play operation. The PC auto-detects the addition or removal of the data acquisition system, so hardware set-up is trivial compared with other data acquisition systems.

Some typical applications for USB I/O systems are automated test and measurement, data logging, temperature measurement, laboratory automation, portable data acquisition, production test, electronics test, and research and development.

Intelligent Instrumentation's first USB Data Acquisition offerings are a pair of Multifunction I/O Systems, each featuring a mix of analog and digital I/O channels. For portability, they feature a novel bus-powered design, allowing the system to be powered from the PC through the USB port instead of from an AC outlet.

The systems can be configured for 16SE/8DIF 12-bit analog input channels with programmable gains, two 12-bit analog output channels, 8 digital input channels, 8 digital output channels, and one 16-bit high-speed counter channel. When combined with Intelligent Instrumentation's new AI-MAX Analog Channel Expansion System, the analog input channel count can be expanded, as needed, up to 256 channels. The systems employ high-speed serial communication with error-checking to transfer data to the PC, guaranteeing that all data will be transferred to the PC at the system's full sampling speed.

A variety of software support is available for these systems. Users can develop USB data acquisition applications with Intelligent Instrumentation's award-winning Visual Designer application generator software, National Instruments' LabVIEW software, or Intelligent Instrumentation's driver libraries for Windows NT and Windows.

For more information circle 166 on the reader service card or contact Kenelec, 2 Apollo Court, Blackburn 3130. ♦

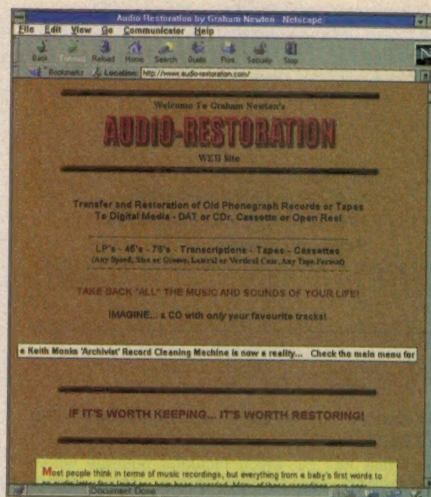
by Graham Cattley

VALVES, TUBES, BOTTLES — call them what you will, but you'll find them all here on Mike's Electric Site at <http://www.netcomuk.co.uk/~www/electric.html>. Actually, its more along the lines of an antique glassware site, with very good pictures of big valves, little valves, neon lamps, Geissler lamps, Nixie tubes, incandescent lamps, reference cells, and in fact just about anything electronic that comes in glass (even resistors).



Mike has a good link list to lots of interesting physics and science sites (some of which I've covered in Webwatch before), and the site also covers a number of high voltage experiments that he's performed. Really though, its a showcase for his enormous antique electronic glassware collection. If the long URL puts you off, try <http://i.am/volts> which will simply re-direct you. Many thanks to EA reader Murray Baker for putting me on to this site.

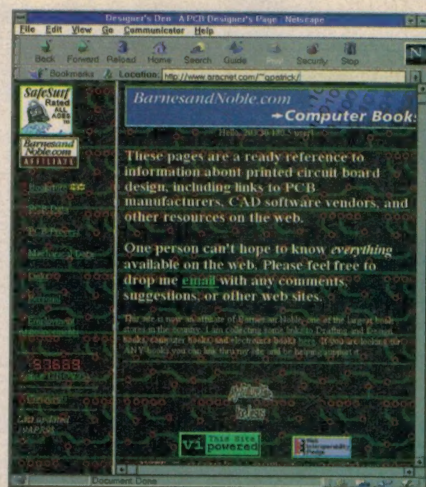
WE'VE COVERED the issue of audio restoration and the transfer of audio material to other media in recent issues, so how about taking a look at a web site devoted to audio restoration with the aptly named URL of <http://www.audio-restoration.com>. As well as offering their services in the field, the site provides a great deal of information on the subject of extracting audio recordings from media ranging from old acetate discs



through to modern tape.

Details on 'baking' sticky tapes to make them playable, through to cleaning discs, tapes and CDs make this site of interest to anyone contemplating the transfer of a recording, and so if you are thinking of resurrecting those old 78s, or want to know the best way to store your recordings, I'd say that this is a good place to start.

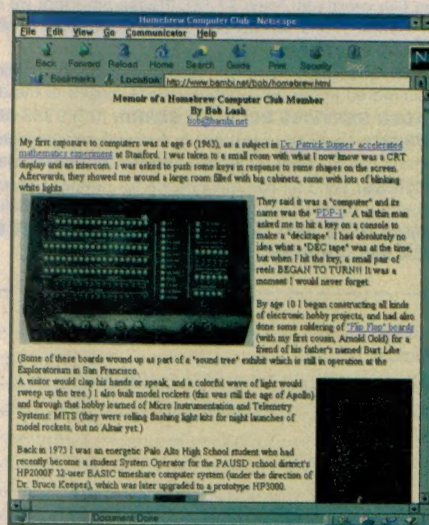
IF YOU WANT to design your own printed circuit board but don't know where to start, try going to <http://www.aracnet.com/~gpatrick/>. Here, George H. Patrick III has outlined the PCB process from schematic through to the finished board, and covers just



about everything you need to know in attempting a PCB design. He assumes that you're using some sort of ECAD software, but he does go into the layout, track thickness, hole size and other practical aspects of making a PCB, as well as the more abstract points like autorouting algorithms.

There are also quite a number of tables on track thickness, wire gauges, drill sizes and PCB material, so the site makes a handy resource if just for this data alone. George says that he has had 14 years experience in the industry, and he seems to know what he's talking about.

IF YOU ARE INTERESTED in early computers (as I am), you might like to see Bob Lash's Memoir of a Homebrew Computer Club Member at <http://www.bambi.net/bob/homebrew.html>. It's not a big flashy page, but he speaks



of the joy of spending a month's salary on a little bag of 256 bit RAM chips, and laboriously typing in byte-by-byte some floating point math routines that Steve Wozniak had given him. There are lots of photos of PDP11s, paper tape and so on, and there are a fair number of links sprinkled throughout the page. Computers these days have lost all their fun, I think, and reading through Bob's page made me sort of wish that I had 56 toggle switches on the front of my system... ♦

EA Directory of Suppliers

Which of our many advertisers are most likely to be able to sell you that special component, instrument, kit or tool? It's not always easy to decide, because they can't advertise all of their product lines each month. Also, some are wholesalers and don't sell to the public. The table below is published as a special service to EA readers, as a guide to the main products sold by our retail advertisers. For address information see the advertisements in this or other recent issues.

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KEY TO CODING

A Kits and modules

B Tools

C PC boards and supplies

D

Components

E

IC chips and semiconductors

F

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G

Reference books

Note that the above list is based on our understanding of the products sold by the firms concerned. If there are any errors or omissions, please let us know.

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PLEASE NOTE THAT WE ARE UNABLE TO SUPPLY BACK ISSUES, PHOTOCOPIES OR PCB ARTWORK OVER THE COUNTER.

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Notes & Errata

Universal IR Controller for a PC (Circuit & Design Ideas, September 1998): A number of readers have pointed out that the circuit as shown won't work, as the open collector outputs of the 7405 can't source current and can only act as current sinks. To fix the problem, the end of R5 should be disconnected from ground and attached to the outputs of the inverters. The anode of D1 should then be isolated from the inverters, and instead taken to +5V. An alternative is to replace the 7405 with a 7404 hex inverter. ♦

NOTE: please quote part numbers in brackets when ordering if available.

LEDs, FLASHING LEDs & PHOTO TRANSISTORS (NOTE: When buying LEDs that most STANDARD LEDs are only 1mC or less!!)

3mm
3000 mC - YELLOW..... 10 for \$5
300 mC - GREEN..... 10 for \$3
1400 mC - RED..... 10 for \$6
Photo Transistor..... 10 for \$5

5mm
3000 mC - YELLOW..... 10 for \$6
300 mC - GREEN..... 10 for \$4
3500 mC - RED..... 10 for \$6
Photo Transistor..... 10 for \$5

5mm FLASHING
3000 mC - YELLOW..... 10 for \$10
60 mC - GREEN..... 10 for \$10
300 mC - RED..... 10 for \$10

10mm
3000 mC - RED..... 10 for \$12

10mm FLASHING
400 mC - GREEN..... 10 for \$12
3000 mC - YELLOW..... 10 for \$12

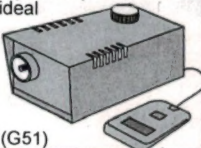
5mm INFRA-RED
850nm 10x the brightness of 880nm but have some visible red \$1.30 Ea. 10 for \$10

***** **MYSTERY BAG OF 100 LEDs** *****

Contains: No standard LEDs!!!
All premium quality, or better with at least (if not more) 1 blue, 1 ultra green and 1 flashing. An absolute steal at \$8 per bag.

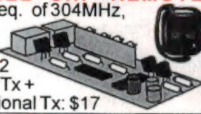
FOG MACHINES

Professional quality fog machines. This unit would be the perfect partner to our laser light shows, ideal for discos, parties, fashion parades etc. A special intro. price of under \$200. Coming soon. Reserve one now (G51)



TWO CHANNEL UHF REMOTE CONTROL

On freq. of 304MHz, transmitter is assembled, receiver is a kit, inc. 2 12V/12A relays, 1Tx + 1Rx kit \$49, additional Tx: \$17



*** **FANTASTIC BARGAIN** ***

COMPUTER POWER SUPPLY PCB:
New assembly. 45 x 108 x 200mm. 120/230V AC input. DC outputs are +5V@6A, +12V @ 1A, -12V@1A, -5V@1A. Data Inc. RU approval. Mains input. Be Quick: (P56) \$12 ea. or 4 for \$36



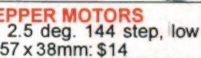
POWERFUL 80 IR ILLUMINATOR

With strong universal swivel mount & 50X50X50mm housing: \$36 For other sizes check our Web Site



NEW STEPPER MOTORS

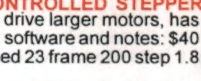
30 oz./in. torque, 2.5 deg. 144 step, low voltage, compact 57 x 38mm: \$14



TWO STEPPER MOTOR DRIVER KITS WITH MOTORS

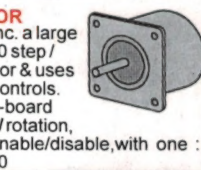
*** **STEPPER MOTOR DRIVER KIT #1** ***

COMPUTER CONTROLLED STEPPER MOTOR KIT: can drive larger motors, has optoisolation. Inc. software and notes: \$40 or \$50 with two used 23 frame 200 step 1.8 deg. motors!!



STEPPER MOTOR DRIVER #2 KIT

Inc. a large used 1.8 deg. (200 step / rev 23 frame) motor & uses SAA-1042A I.C. Controls. inc. ext. clock, on-board clock CW or CCW rotation, half / full step, enable/disable, with one: \$20 / 2 motors: \$30



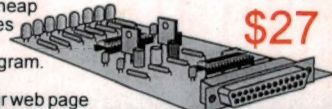
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KITS OF THE MONTH

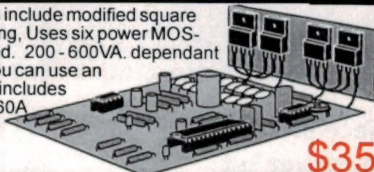
PIC MICRO PROGRAMMER JUST \$25

Design your own microprocessor controlled devices or even products and maybe make your fortune! Learn program your own 16F83 / 16F84 / 16C84 micro-controllers with this kit the simple way. With this small, cheap but powerful chips Kit inc. program examples and notes PCBs, all on-board components, DB25 connector and a PIC chip ready to program. An incredible bargain at just \$27
Software available free to download from our web page



\$27

12VDC - 240AC INVERTER Features include modified square wave output, Auto start with load sensing. Uses six power MOS-FETs with minimal heatsinking required. 200 - 600VA. dependant on transformer size. To save money you can use an rewind your own transformer. Basic kit includes PCB & all on-board components + 4 X 60A MOSFETs. \$35 Requires 240V to 8-0-8 V transformer. Ring or E-Mail for more details.



\$35

WE ARE LOOKING TO BUY NEW & USED SURPLUS OR OBSOLETE STOCK COMPONENTS, MODULES, PCBs, MECHANISMS, MOTORS, GEAR BOXES, HOUSINGS, CABLES, CONNECTORS, SWITCHES, METERS, COMPLETE ASSEMBLIES JUST CALL OR FAX WITH THE DETAILS. WHAT MIGHT APPEAR TO BE WORTHLESS TO YOU MAY BE VALUABLE TO US. LARGE OR SMALL QUANTITIES YOU MAY BE SURPRISED WHAT YOUR STOCK IS WORTH!!!

LASER DIODE POINTER KIT

Did you ever imagine you could buy a very bright laser for just \$15? well guess again!!! (K35)



\$15

NEW 1/2/3 AXIS CNC SYSTEM.

(computer numerical control) This system includes a new stepper motor driver kit (one kit required for each axis) designed to be used with software freely available on the Internet for use with home or professionally built a milling machine, lathe, engraver or cutter etc. with home & limit switches and a high degree of accuracy (can be better than .001"). We supply the kit inc. Pcb all on-board components etc. plus Internet resources shareware software & building or buying mechanical components. Around \$30 per axis. Call for further details.

UNIDIRECTIONAL ELECTRET MICROPHONE

New quality product with clip, 3M lead, 2.5mm plug: \$4 Make a stage quality wireless microphone by combining it with our FMTX MK2 trans-mitter kit: \$16 for the kit plus the microphone



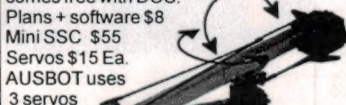
*** NEW *** NEW *** NEW ***

HIGH POWER IR TRANSMITTER AND RECEIVER Applications include data transmitter, powerful Passive infrared detector, IR invisible fence / gate & doorway monitor. Range: with 5 IR LEDs (can drive up to 50 LEDs) passive mode 10m (5 LEDs), active mode 40m (5 LEDs). Range can be boosted with a cheap torch reflector. The kit has active high & active low outputs for relays etc Simple to construct PCB can be cut into two for active mode or for data transmission. Kit inc. PCB, all on-board components, 5 IR LEDs + salvaged new plastic case All for \$28

2 AXIS ROBOTIC ARM WITH GRIPPER

REF. SC Dec.97. This robot uses the well known Mini serial servo controller to control up to 8 servos from your computer's serial port using Qbasic that comes free with DOS.

Plans + software \$8
Mini SSC \$55
Servos \$15 Ea.
AUSBOT uses 3 servos



*** SPECIAL ***

MASTHEAD AMPLIFIER KIT (K03)
Our famous MAR-6 based masthead amp. Up to 2Ghz. 2 section PCB (power supply section. can be indoors): Kit includes Plugpack: and 2 Weatherproof boxes: \$24. (MAR-6 avail separately)



\$24

NEW!!! CODE HOPPING UHF MINI TRANSMITTER / RECEIVER PAIR

High security in a very small transmitter and receiver (key-fob size) pre-built package. Both crystal locked on 433MHz, with approx. 100m range. The receiver will drive central locking systems, indicator relays, boot release relays, flashing lights and more: \$100 for 1 TX & 1RX. extra Txs: \$30. 12V-12A relays: \$2.50 Ea.



KEY-CHAIN LASER POINTER

Very bright 650nm laser pointer in a high quality machined metal housing

FOR SALE TO ADULTS ONLY

VERY BRIGHT LASER MODULE

650 laser module as used in the above pointer. (Lm2)

FOR SALE TO ADULTS ONLY

3 LED LOGIC PROBE KIT.

(ref SC May) Ideal for tracing digital / logic faults & powered by the circuit under test. Inc. Only PCB, all on-board components, LEDs, LED bezels & Oatley's special case (approx. 35x24x123): (K119) \$7



CGA COLOUR MONITOR..... NEW 12V

DC-1A "6" colour monitor, ready to be enclosed, no housing, just the tube, driver PCB's and data sheet. now just \$40 (G62)



TRANSISTOR SPECIALS

BU-205
HIGH VOLTAGE \$2.50
2SD-1554
HIGH VOLTAGE \$5.00

20-30 SECOND DIGITAL SOUND RECORDER KIT.

This could be used as an answering machine at your front door or as a personal reminder device. Good quality sound Uses LSI chip with memory etc. built in. Kit includes PCB all on-board components, microphone, switches & speaker. \$14 (K124)



Series 13 - 4 CHANNEL UHF RECEIVER.

Ref: EA Mar 94. Control up to 4 output relays. Uses a pre-built and pre-aligned UHF (304MHz) receiver module & security coding ICs. Output relays have 5A contact ratings and can be configured for toggling operation at each press of a Tx button or momentary operation when Tx button is pressed. 1 X 3ch transmitter plus 1 X 4ch receiver: \$50 extra Tx \$15 is req. to access the fourth relay. 12V operation. (K39) \$70

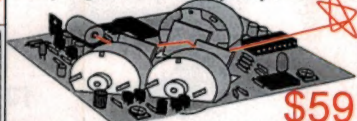
LARGE 70mm HIGH 7DIGIT 7 SEG. LED DISPLAY PCB ASSEMBLY. (no data available) JUST \$20 (D12)



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MKIII. Automatically changes every 5 - 60 secs, & is adjustable. Each motor has 8 speeds, one motor is reversible, & one can stop. Countless great displays from single to multiple flowers, collapsing circles, rotating single and multiple ellipses, stars, etc. Easy mirror alignment with "Allen Key". Kit inc. PCB, all on board components, three small DC motors, mirrors, precision adjustable mirror mounts: (K115) + very bright 650nm laser (LM2) module



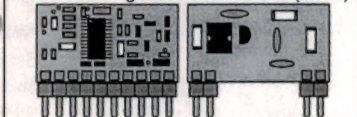
\$59

SPECIALSPECIAL**SPECIAL**

FOR \$1 EXTRA WITH EACH ORDER WE WILL SEND WIRING KIT !!!
Great for cars, radios mobile phones, fog lights etc. 4 colours, 2 gauges of wire, Spade connectors, fuse holders, fuses. 17+ mtrs. of wire. **Limited offer!!! just \$1**

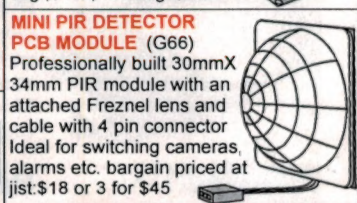
UHF DATA TRANSMISSION

Stamp sized Xtal locked 433.9MHz superhetrodyne receiver module \$25 Small matching transmitter kit: \$12 (K122)



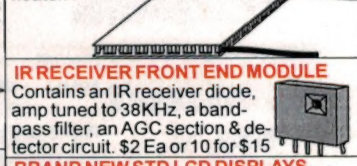
** CCD CAMERA SPECIAL **

WITH A FREE UHF MODULATOR
The best "value for money" CCD camera on the market! 0.1 lux, High IR response & hi-res. Performs better than most cheaper models. **42mm** With: Pinhole (60deg.), 78 deg.; 92 deg.; 120 deg.; \$89 or 150 deg: \$104
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SOLID STATE 4-6A PELTIER EFFECT COOLER / HEATER

3.3A@14V(GP1) PELTIER: \$27, 6A @15V(GP2) Peltier: \$35, both are approx. 40X40X4mm, temperature controllable by reducing supply voltage / current, will even work from a 1.5V battery!! With data sheet, diagram & circuit for a fridge / heater.

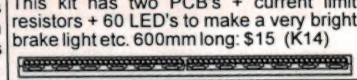


IR RECEIVER FRONT END MODULE

Contains an IR receiver diode, amp tuned to 38KHz, a band-pass filter, an AGC section & detector circuit. \$2 Ea or 10 for \$15

BRAND NEW STD LCD DISPLAYS

1 line x 16 : \$16 (D03)
2 line x 16 : (D14) with LED back-light: \$24



*** NEW DESIGN ***

*** BRAKE LIGHT INDICATOR-60 LED KIT

This kit has two PCB's + current limit resistors + 60 LED's to make a very bright brake light etc. 600mm long: \$15 (K14)



Where do you GO for the last word in electronics?

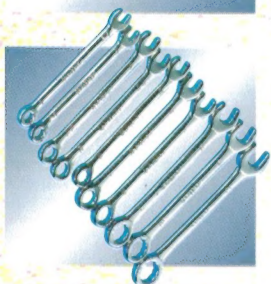


6-piece precision screwdriver set

A handy selection of flat-blade screwdrivers with strong steel alloy blades.

T 4364

\$7⁹⁵



10-piece mini spanner set

A handy set of quality metric spanners covering most sizes between 4mm and 11mm. Suitable for light/medium duty uses.

T 4550

\$17⁹⁵



5-piece reversible ratchet wrench set

Set of handy offset box-end wrenches that provide reversible end travel through a simple lever adjustment. Sizes: 5.5, 6, 7, 8, 10, 11, 12, 13, 14 and 17mm.

T 4560

\$26⁹⁵

AND HANDY ELECTRONIC TOOLS?



Adjustable visor magnifier

Lightweight visor slips onto your head and flips down when magnification is required. Selectable 2.2x and 3.3 x magnification.

T 4593

\$29⁹⁵



Handheld mini vacuum cleaner

Great for cleaning keyboards, hi-fi equipment and monitors. Its brush/tube head gently sweeps dust from the surface being cleaned before vacuuming it away.

T 1705

\$32⁹⁵

FOR THE BEST RANGE OF BIT SETS...

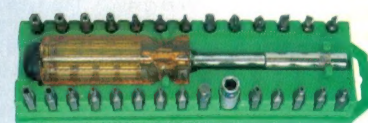


20-piece bit set and ratchet driver

General purpose tool kit with ratchet driver handle, magnetised bit holder, 20 various bits and handy storage case.

T 4502

\$19⁷⁵

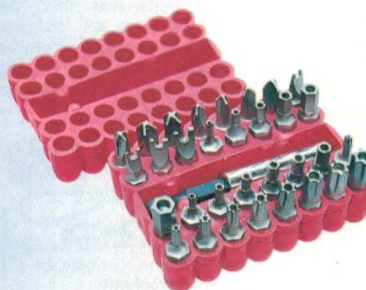


Driver and 29-piece bit set

Strong driver handle with magnetised tip and storage case. Bits include: flat blade, Phillips head, Hex, security Torx and more.

T 4503

\$26⁹⁵

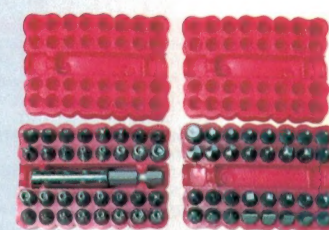


32pc security bit set

For use with equipment with security screws. Includes Torx, Hex, Tri-wing, pin drive, magnetised bit holder and soft plastic case.

T 4506

\$16⁹⁵

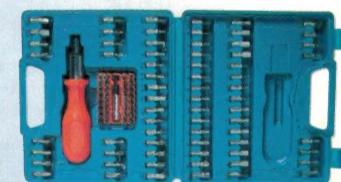


64pc security bit set

Packed into two soft plastic storage cases for easy carrying. With security Torx, Tri-wing, Hex, Phillips bits, magnetic bit holder and more.

T 4501

\$26⁹⁵



101-piece bit set

Includes a hard plastic carry case, driver handle, and magnetised bit holder. With flat blade, Phillips, Square, Torx, Hex, Security Torx, Security Hex, Tri-wing, Spanner, Torque bits and more.

T 4513

\$34⁸⁰

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